THE IRON TRADE REVIEW

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THE IRON TRADE REVIEW.

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IRON AND STEEL INDUSTRY, THE MACHINERY TRADE AND KINDRED INTERESTS.

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CLEVELAND, O., APRIL 4, 1889.

THE WEEK IN IRON CIRCLES.

General Features. Perhaps the most noticeable feature of the outlook is the continued buoyancy of the European markets. In nearly every department, the greatest activity prevails. Especially is this true of Scotch pig irons, for Continental delivery. On this side of the Atlantic, there does not seem to be a single change for the better. Indeed, if anything, the feeling is weaker. Sales of steel rails, during the past few weeks, have been practically *nil*. Southern irons are still making their way into Eastern markets, thus materially curtailing the orders for Eastern-made brands. The situation is also complicated by high freight rates on fuel and raw material, and impending labor troubles. With the single exception of the the Lake Superior charcoal market, which has been quite active the past week, and the Southern markets, which appear to be getting on their feet, our special reports indicate no change for the better. The one ray of hope is contained in the following report from Detroit: "The market has been more active during the week under revie than for some time past, and a number of orders for round lots have been booked. The Lake Superior charcoal trade has been especially lively, and several large concerns have purchased who do not usually place orders until later in the season. There seems to be a growing impression among consumers that those who place orders early will obtain the most favorable terms and lowest prices, and sellers anticipate a large amount of buying in April. While the demand for coke irons has not been so large as for Lake Superior charcoal, yet it has shown more strength than recently." At Louisville, the market has been more active the past week than for some time past. Inquiries have been numerous, and several good sales have been made. Prices are firmer and show a slight increase. Southern furnaces do not seem inclined to take orders for very long deliveries, at present prices, and there seems to be a much better feeling among them. St. Louis reports extreme dullness, with no buyers for round lots. The same state of affairs prevails at Pittsburgh—a weak market but prices not quotably lower. Buyers are few and operating with caution, but furnace men can hardly make further concessions without absolute loss. Such slight buying as prevails at Cincinnati is about equally divided between orders for immediate needs and providing for the next four and six months. There are no changes of note in prospect calculated to affect the rate of supply, tributary to the Cincinnati market. Two or three Southern coke furnaces have blown out for repairs, and their places taken by a coke and charcoal furnace just blown in, after a couple of months' idleness, and one new coke furnace which starts next week. In the Hanging Rock district one charcoal furnace begins another blast next month. The Jackson County district has less furnaces running than for several years. Business in progress at Chicago is mostly of the retail sort, relieved by one or two good-sized orders for soft iron and Lake Superior charcoal. Work in the jobbing foundries is less active. Information is received of two or three Ohio furnaces making soft iron preparing to blow out. Makers say that the pleasure of trading one dollar for another in making and selling iron does not compensate for the labor and risk involved. The very open Winter has prevented the usual amount of wood chopping and hauling by Northern charcoal furnaces, and the short fuel supply will probably put some furnaces out of blast.

Iron Ore. The situation set forth in detail last week remains practically unchanged and no large sales have been reported since those already alluded to were consummated. There is a feeling everywhere of confidence, not only in the stability of the market when it shall have been established, but also of a material increase in the amount of ore to be mined and sold this season. On all sides are heard estimates of a largely increased output, varying all theway from 25 per cent. to 150 per cent. Thus, for instance, it is reported that the Palmer mine, located near Ishpeming, which was recently sold to Gov. Alger for the reputed amount of $750,000, and which produced last season some sixty thousand tons of ore, will, it is said, this year put out one hundred and fifty thousand tons of ore. The Palmer ore, by the way, is 64 in iron and from .065 to .08 in phos. The owners of the Norrie expect to mine half a million tons this year, which is an increase of seventy-five thousand. The Pence and Hennepin, the Aurora, Dunn, Chapin, and nearly all the larger mines predict increased outputs, so that everything looks favorable for those interests at least, located at and directly affecting the neighborhood of the mines. There is still a large divergence of opinion as to the price of some ores, and some sales that may have been made are carefully kept quiet. Non-Bessemer Chapin ore is held at $5, but no price has been fixed for the Bessemer grade of that named, although $5.60 has been named by the interested party as the probable price. There are those who take exception to the report published in these columns as to the price Norrie is said to have been sold at to the Chicago steel syndicate. The price reported was $2.60 on board the cars at the mine, but it is claimed that a much lower price was named, $2.35 being mentioned by one ore dealer. At the rate of $2.60, allowing seventy cents for rail freight to the lake, $1.25 for lake freight and five cents for insurance, &c., the price of Norrie in Cleveland would be $4.60, but the agents decline to make that price here, expecting a substantial advance over last year's price, which was $4.50. The reason given in some instances for the refusal to quote a price is said to be the unsettled condition of lake freights. It may be accepted, however, as a fact, that for season charters at least, $1 from Escanaba and $1.25 from the head of the lake will be not far from the price. Little difference will distinguish between Ashland and Marquette charters, the increased sailing time to the former port being compensated for by superior loading facilities at the latter.

Pig Iron. The market offers no encouragement to producers, and trade, in the language of a leading furnaceman, is "flat as a pancake." No good reason exists and none is adduced for this state of affairs, the upward movement of three weeks ago having dispelled the doubts on the part of consumers as to the stability of the market. Still, the heavy trade predicted at that time hangs fire, and both furnacemen and buyers are feeling their way with the utmost caution. A good deal of iron is changing hands in one way or another, but without satisfaction to either producer or consumer. While a prime grade of foundry iron is sometimes held at $17 at the furnace, mill iron has lost ground, and a sale is reported at $13.75, four months. Just a week ago the same buyer was refused that quantity of iron, at that price, for 30 days' account. The lack of extensive ore sales undoubtedly bears directly upon the pig iron market and as the ore business progresses there is good reason to expect a better market for pig material.

Merchant Iron. Little is doing in any of the lines, and quotations are anything but strong. Bar iron and sheets are in small demand, the rail orders continue light and the only branch doing fairly well is the shape iron market.

Scrap Iron. Old American rails are variously quoted at $22@$23, but no sales are reported for the week. There is no market for wrought scrap or car wheels, while axles find a ready sale.

Hardware. The trade is excellent, and jobbers have no time to specify any particular quotations, being occupied day and night with the filling of their orders.

THE RAILROADS AND THE IRON BUSINESS.

Mr. Andrew Carnegie not only struck the nail on the head, the other day, but he drove it home as well, when he laid at the door of the railroads the serious charge of driving by their extortionate rates several of our largest iron works from the East to the South, where a much more liberal policy prevails. A contemplation of the record of the past few months is more instructive than pleasurable. Samuel Thomas, of the great Thomas Iron Company, in the Lehigh Valley, has gone to the South. Abraham Patterson, who has had prosperous furnaces in the Schuylkill Valley, was driven to Southwest Virginia. Samuel Crozier finds Roanoke better than Chester for his iron interests. The Pennsylvania Steel Company is moving to Eastern Maryland to secure better facilities, and now comes the positive announcement that the well known iron firm of Cooper, Hewitt & Co., of Trenton, N. J., have decided to transfer some of their interests to Chattanooga, Tenn. The problem before the latter firm was a simple one, and reflects little credit upon the railroad policy prevailing in New Jersey and Pennsylvania. At present the raw material has to be freighted to Trenton at large expense from Southern points and from Pennsylvania, and then shipped back at additional expense over much the same route in the shape of finished products to the markets. The fact of the works being located so far from the coal and iron fields makes the freights much higher. In the South, the firm found that freight rates were less than one-half of those in the North. The best coal is delivered right into the yards of the Tennessee Coal & Iron Company, the Atlanta Rolling Mill and the Chattanooga Rolling Mill for $1.25 per ton. It is delivered at the New Jersey Steel & Iron Works, and all other works in Trenton, for $3.25, and at the former works 38,000 tons are used per year. Thus it will be seen that $2 would be saved on every ton of coal, or $76,000 a year. This would be sufficient alone to pay a handsome dividend; and there is the same relative difference in iron freight rates.

What is true of the Trenton concern, is also essentially true of the works in Eastern Pennsylvania. Furnace men in the Schuylkill Valley pay $2.75 per ton for coke from Connellsville, while the Pennsylvania Railroad, which carries for them, ships iron to compete with them, from beyond Pittsburgh, to any point in the Schuylkill Valley for $2.00 per ton. Then, as if to add insult to injury, it refuses to carry Lake Superior iron ores to these furnaces for less than $1.75 per ton, in the face of the fact that the railroad company carries immense quantities of coal to the lake ports for shipment to the Northwest and with its empty cars back could well afford to make a reasonable and even a low rate to the Schuylkill Valley. As it is, knowing that the Eastern Pennsylvania furnace men must have the lake ores to mix with their native ores, the railroad company puts on a freight rate that sends the cost of non-Bessemer ores at the furnaces up to from $6.25 to $6.75 per ton, and Bessemer ores from $7.25 to $8.25 per ton.

Is it any wonder that there should be a shifting of iron centers toward a section where more decent treatment is accorded? The duty of the business men of America will not be done until they grapple this evil of extortionate rates and bring the North on at least competing terms with the other more favored sections of the country.

"THESE STOCKS ACT LIKE A SPECTRE."

That a fair share of American blast furnaces would be drawn into the pig iron warrant scheme was a foregone conclusion. To paraphrase Andrew Carnegie, not a few furnace men are compelled by the exigencies of the business to resort to the pawn broker. Then there is always present in the minds of some men a covert desire to indulge in speculation. These two classes of furnace men would naturally be expected to take kindly to the new scheme, especially under the persuasive eloquence of paid agents sent out to scour the country in the interest of the American Pig Iron Storage Warrant Company. It is not surprising, therefore, to learn that, up to date, the company has "already contracted with twenty of the leading furnaces in the states of Pennsylvania, Ohio, Tennessee and Alabama, for the handling of their product"; that "the furnaces in question represent a capacity of 850,500 tons, and, in addition to these, other furnaces with a capacity of 629,000 tons have agreed to sign contracts to the same effect," and that "storage has already been actually engaged for about 30,000 tons." Counting the birds in the bush as equivalent to being in the hand, this would make in all a capacity of 1,442,500 secured out of an aggregate capacity in the United States of 6,000,000 tons, or about one-fourth; or, if we count only such as have actually signed, the secured capacity would amount to but about one-seventh of the whole. Just wherein is found the basis for the assumption, on the strength of these facts, that "that there will gradually come into this arrangement such a proportion of the outstanding furnaces as will give substantial unanimity to the project," is difficult to see. That, even if successful in drawing in one-half or two-thirds of the productive capacity of the country, it will prove "a great boon"—as Artemas Ward would have said—to the iron trade, we seriously doubt. As against the theories of the projectors, we put up the following assertion made by probably the highest iron authority in the world, Sir Lowthian Bell, in an address recently delivered before the Wolverhampton Chamber of Commerce: "*The chief influence to-day that is exercising a bad effect upon the English iron trade is undoubtedly the immense stocks of pig iron held in Scotland and Cleveland and allied districts. In previous years half a million tons of stock was considered a healthy amount, but now we have got up to over* 1,000,000 *tons in Scotland and* 800,000 *in other districts. These stocks act like a spectre.*"

Should any considerable proportion of the iron trade of the United States go into this project, we believe the experience of England would be duplicated on this side of the Atlantic, and we call upon the Wall street organs—we believe there is no other class of papers in this country now actively supporting the scheme—to give a solid, substantial reason why this would not be the legitimate and necessary outcome.

WATER TRANSPORTATION OF IRON ORE.

We do not share in the apprehension that the proposed ship canal across the Upper Peninsula of Michigan, to connect Lake Michigan and Lake Superior, will, if ever built, seriously interfere with the iron ore traffic at present coming to lower lake ports. Chicago would probably be able to work up and supply a good market in the West and Southwest, but the natural gateway to Central and Eastern consuming districts is Cleveland, and Cleveland it will always remain. The project itself has much to commend it. It is proposed to cut a canal across the peninsula from Gladstone, a town near the head of Little Bay de Noquet, an arm of Green Bay, and run it due north to Au Train Bay, on Lake Superior, a length of about thirty-five miles. Au Train Bay is about twenty miles east of Marquette. This canal would shorten the distance between Chicago and Duluth some 270 miles, and report says it would be a comparatively simple undertaking. The canal would require but two locks. The estimated cost is $3,000,000, and the Government is asked only to bear the expense of an official survey.

From a sentimental standpoint the building of such a canal would be undesirable, since it would divert from the Sault Ste. Marie Canal a considerable portion of the traffic which now goes to make an annual tonnage far in excess of its more noted compeer, the Suez. The figures of comparison have already been given in these columns, but will bear repetition in one or two particulars. The daily registered tonnage through the Sault for 1886 was 18,837 tons, while that through Suez in the same year was 15,802 tons. The lake vessels average about half the tonnage each of those which conduct the trade between Europe and the far Orient, for the whole number of registered vessels passing through Suez in the same year was 3,096, while the number passing through St. Mary's Falls was 7,118. The number through the Sault Ste. Marie in 1887 was increased to 8,823. In the 212 days of navigation in 1888 there passed through the Sault canal an aggregate tonnage of over 6,200,000. This, for seven months of navigation would average 900,000 per month, or nearly double the monthly tonnage of the Suez canal for the same year.

With the contemplated improvements, however, St. Mary's Falls Canal could well afford to lose a portion of her tonnage, since the present annual transportation of iron ore from Lake Superior ports to Chicago is only about 200,000 tons. The necessity of these improvements will be heightened not only by the possible construction of the new canal but also by the increasing needs of our modern tonnage, and the comparatively small cost of the work, amounting, even with the original cost of the canal, to less than one-twelfth of the cost of the Suez Canal.

THE cause of Protection is making rapid strides in Australia. The Sidney (N. S. W.) *Trade Review and Prices Current*, an out-and-out Free Trade journal, states that at a recent session of the House, an adjournment was moved by the Opposition (Protectionists) and carried. The government thereupon resigned; and, after the mover of the resolution declined to endeavor to form a new administration, the Governor sent for Mr. Dibbs, the leader of the Opposition, himself a member of the Protectionist party. Parliament—mainly composed of Free Traders—refused the new government any supply, a dissolution of the House followed, and a general election came on, of the result of which we are not as yet advised.

WHERE TO SEND MACHINERY.

That excellent publication, *Kuhlow's* (Berlin), makes the following suggestions to German makers of machinery, which may be read in America with profit:

"Meantime there is throughout Asia Minor a splendid opportunity for the introduction of machinery, the field at present being entirely unoccupied. There is a great abundance of water power in the country, although at present it can hardly be said to be utilized. There is not a board of any sort, or even a plank or beam, ever sawed there by any other power but that of the human hands. There is, therefore, a good opening for wood-working machinery. There ought also certainly to be an opportunity for agricultural implement makers to introduce their products into Asia Minor, as such implements as are at present in use there are of the most primitive description. The spades and shovels are made out of wood, each being cut out of one solid piece of timber. The plows, as we have before now informed our readers, are also of wood. Indeed, such implements cannot be called 'plows' at all, as they are only pointed sticks, which comparatively seldom have even an iron pointed cap upon the point which scratches, and is supposed to turn over the soil. Manchester supplies most, or perhaps all, the cotton prints which are imported, and great quantities of which are used for clothing, divans, bedding and such like purposes.

"The activity in gold mining speculation and 'booming' continues in the Transvaal and adjoining regions, the last resorts of finds of marvelous richness and extent coming from the native country, north of the Dutch Republic, and with it all there is really a large amount of money being expended in work and machinery, and in a few cases very promising returns for the capital already invested are being received. In a considerable number of instances the milling plant selected and purchased has been of our make, but the superiority of our manufacture and arrangement of that class of machinery is so universally acknowledged by mining men and engineers, that we are almost astonished that any other should find its way into such a gold field as this South African one appears to be. The remoteness from any means of making repairs demands the best workmanship, so that repairs shall be reduced to a minimum, and the cost of supplies must always make milling charges high, therefore, all the more reason for the most improved machinery, doing its work automatically and economically. The English stamp mills, as illustrated in the many examples we have seen abroad and in Cornwall, are wholly unsuited to such conditions as exist in the Transvaal and the English colonies, and there are enough American experts in those countries to educate the mine owners up to a knowledge of what is good and where real economy is to be found. Our manufacturers of mining and other machinery should cultivate these new fields, and especially at this time the Transvaal, which is now in bonanza, and its stocks are 'booming' on the London market. The English mills are antiquated, and, in fact, in Coruwall, the historic seat of mining, nearly everything is 'behind the age.' As an illustration of the spirit prevailing there, we are told that on a recent occasion a fire occurred at a well-known mine near Penzance, when the first fire engine called into requisition, literally fell to pieces from old age (age not stated) and it was replaced by the younger of the two fire engines belonging to the corporation of Penzance, but which had already passed the respectable age of ninety years! The English gold mills may not be as old in fashion as this fire engine,, but they are, nevertheless, out of date, and those who have to work mines in out-of-way places cannot afford to use any but the very best and most efficient and durable appliances."

IRON AND STEEL DIRECT FROM ORE.

F. L. Garrison, of Philadelphia, some time since visited the iron works of Count Stroganoff at Dobransky, Perm, Russia. He also saw the iron works in the eastern part of Finland, near Lake Ladoga, and described the furnaces in use at the latter place, which have double walls of soft iron plate, and are very effective. Favorable results are accomplished by the peculiar circulation of the blast through the hollow walls of the furnace and by the insertion of the tuyeres into the hearth itself.

The walls of the furnace are of wrought iron plate, the whole being enveloped by a second wall or shell, extending from the hearth to the throat, thus forming a series of zones, divided by spiral partitions, making a continuous flue, coiled, as it were, around the furnace. The blast, passing through this, is heated under ordinary circumstances from 150°–250° C. (302°–482° F.), though sometimes running up much higher. By means of a system of dampers and pipes, the circulatiou of the blast through these chambers or flues can be regulated with the greatest ease. If the blast is too hot, the upper and middle chambers are shut off; if, on the coutrary, it is too cold, the upper chambers, which are frequently not used at all, are opened. This contrivance, together with the movable hearth, gives a most effectual control over the operation of the furnace. To check loss of heat by radiation, the outer shell is coated on the outside with a four-inch layer of fire-clay.

The other most important improvement made in the furnace was the insertion of the four tuyeres directly into the movable hearth. There are four tuyere holes in each of the two opposite sides of the hearth, the lower being three inches and the upper six inches from the bottom. When a fresh hearth has been inserted and a new loupe is beginning to form, the tuyeres are inserted in the lower holes; as the loupe increases in size their inclination is lessened, the object being that the blast should just impinge upon the surface of the loupe. When the loupe has grown up nearly to the level of the lower tuyere holes the tuyeres are removed, placed in the upper holes, and the lower ones stopped with clay. The same operation is then repeated until the loupe reaches the level of the upper holes, when the tuyeres are taken out and the hearth is removed and replaced with a fresh one.

Thus the operation is practically continuous, the blast being stopped for about five minutes while the hearth is being replaced. The hearth stands upon a vertically moving platform which can be raised and lowered a few inches, thus permitting a tight joint being made between the furnace proper and the hearth, the crack of about an inch between the two being first carefully luted with clay before the hearth and platform are raised. The slag is tapped off into a car running under the hearth by a series of four holes, one above the other. The hearth containing a fresh loupe, after being replaced by another, is revolved on the axis over the cast iron arms.

THE COST OF OCEAN STEAMSHIPS.

An order for a new ship of the class required to compete in the modern passenger service of the Atlantic is not by any means a matter to be determined on without grave consideration. Speed is costly, and as you increase it it is generally necessary to also increase the tonnage. This forces upon your consideration tides, channels, harbor bars, and dock accommodations, all of which impose limitations upon you. And then the cost of the ship herself is not a matter which even the wealthiest of corporations can provide for at a moment's notice; it is not one hundred thousand dollars, nor five hundred thousand dollars that the work calls for, but about five times the latter sum, for it is safe to say that a vessel superior to the City of New York or the Etruria could not be built for less than two million and a half of dollars.

Sometimes the ship-builders are willing to become part owners of the projected vessel; sometimes they take as part payment for the work some older vessels of the line, which they refit, re-engine, modernize, and sell again. The ability of the builders to make an arrangement of this kind, of course, influences the placing of the contract, in a measure, but they must also be able to give certain guarantees. They must enter into an engagement that the projected ship shall be able to carry so many passengers and so many tons of cargo, and to attain a specified speed on a given consumption of coal per day. Let us say, for instance, that the stipulations are these: Accommodations for 600 saloon passengers, 150 intermediate passengers, and 1,500 steerage passengers; registered tonnage, 6,000; speed, 19 knots on a consumption of 300 tons per day. If the ship fails to fulfill these conditions the builders agree to forfeit a part of the amount they would otherwise receive for her, or they may be compelled to take her back altogether. This was the case with the City of Rome, which was built for the Inman line by the Barrow Ship-building Company.—[From "The Building of an Ocean Greyhound," by William H. Rideing, in *Scribner's* for April.

Analyzing Steel and Iron for Structural Purposes.

The extreme accuracy required in the chemical analysis of steel and iron for structural purposes has become so great that chemists find that the errors of weighing, also those which are personal to the operator, and those due to the process employed, are sufficient to cause considerable confusion in a comparison of the results of analyses. To remedy the evil, the *Railway Review* states that Prof. J. W. Langley has proposed that a system of international standards of iron and steel be obtained, and his plans have met with approval. The method of procedure is to have a number of ingots of steel cast in lots whose composition shall be as near as possible 1.3, 0.8, 0.4, and 0.15 per cent. of carbon respectively. These lots are kept separate. The skin of each ingot is to be removed and the metal then cut into fine shavings, which shall be crushed, sieved and intimately mixed. These shavings shall then be hermetically sealed and an equal portion sent to each of the five countries which have entered into the plan, namely, Sweden, Germany, England, France and the United States. The committee in each country shall then carefully analyze their samples, and averages of all the analyses of each lot be taken as the correct ones. The remainder of the metal in the hands of the committee shall then be held for distribution in the countries in which they are now located. A chemist, by an analysis of a sample thus obtained, can find a factor by which he must multiply his results to make them agree with the international standard.

"Drop a Nickel In the Slot."

We are all familiar with the legend, "Drop a nickel in the slot." As a contemporary expresses it: "One can be weighed, have his strength tested, secure some chewing gun or a package of cigarettes, have his handkerchief perfumed, buy postage stamps and stationery, or even insure his life, in this most convenient way." The latest device that we know of in this line is the "pre-payment gas meter," invented in England, by a Mr. Brownhill. A penny deposited in the proper place will cause the meter to work for six or eight hours; and if several pence are deposited, the time will be increased proportionately. By this means, the inventor hopes to save the gas companies considerable trouble, aud also to enable small tenants to buy their gas at retail.

Artistic Japan is a most unique and sumptuous art magazine, now for the first time reprinted in America. Its object is to educate the public in the real art of Japan: first, by reproductions of examples which the taste of the world has stamped as the purest and best, and which will be selected for their fitness to the requirements of every class of society; and next, by treatises by those who have made Japanese art the subject of study, and who are qualified to speak authoritavely on the subject. The amateur, the collector, the manufacturer, the student, and even, it is hoped, the artisan, will find in each number an illustration of at least one object which will repay him its cost. Address *Artistic Japan*, 220 Fifth avenue, New York.

THE extraordinary success of "The Quick or the Dead?" renders the appearance of a new novel by Amelie Rives, in the April number of *Lippincott's Magazine*, an event in the literary world. "The Quick or the Dead?" has been more widely read and discussed than any novel of recent times. "The Witness of the Sun," Miss Rives' new story, is replete with dramatic situations, and gives further and stronger evidence of her rare power in depicting human emotions.

AMONG THE IRON MINES.

Menominee Range:—

The Chapin has, probably, 80,000 tons of ore in stock, and the necessary "rockwork" having been done, the force on ore will be materially increased from this time forward, and although the product for '89 will not reach the figures predicted by many, it will still be large enough to maintain the record of the mine as a mammoth industry, while the work of adding to the facilities for mining will go on until the mine shall take a permanent position as the greatest producer of iron ore in the country.—[Current.

The *Current* says "A" shaft at the Ludington has reached the 10th level and preparations will be at once made to sink another 100 feet. Some improvements have taken place in the appearance of the mine at the 9th level. The working force is being added to, and the mine will make a much better record for '89 than it did in '88.

We learn that the exploratory work being done on section 10. 39-29, by the Penn Iron Mining Company, is giving satisfactory results for the amount of work done, and that there will be no cessation of work until the whole property has been thoroughly developed.—[Mining News.

Late information would seem to indicate that the Youngstown mine is to be wrought this season, but as two properties and by two companies. At present the property lies in two sections—nineteen and twenty—the engine house, shops, and office, stand on the former, while the work of late years has been done on the latter. The Youngstown Co. proposes to give up its lease of the northeast quarter of the southeast quarter of section nineteen, and remove the machinery, etc., to the northwest quarter of the southwest quarter of section thirteen, and vigorously work that end of the vein, which is known as the Nelson shaft. A company, of which C. T. McElroy, of Norway, is included, is being formed to operate the section nineteen, or west end. The Youngstown shipped five seasons and accomplished an out-put of nearly 100,000 tons. The property is a large one and under favorable circumstances can do great work The resumption of operations at the Youngstown is a good bit of news to Crystal Falls people.—[Diamond Drill.

A promising vein of ore has been cut at the McCusker exploration on section twenty-three, 43-32. The vein when first encountered showed a width of scant two feet, but as depth is reached the vein widens. The gentlemen interested are firm in the belief that a working body of ore is at hand.—[Diamond Drill.

Gogebic Range:—

The Bessemer mine was sold Wednesday to C. H. Hildreth, of Chicago, for $16,850. H. S. Benjamin, of Milwaukee, bid it in for Hildreth. A. J. Agnew, the receiver, conducted the sale. The Bessemer is one of the best mines on the range, and at the price is considered a great bargain.—[Mining News.

Of a recent visit to the "Giant," Colby Mine, the *Pick and Axe* says: It is in the fifth level, however, that the best idea of the immensity of the deposit of iron is got. The rock dike mentioned above scarce reaches to this level at any point, leaving a clean body of ore opened up to view by drifts and cross cuts 120 feet or more in width and more than five times as great in length. The rooms that have been mined out on this level will be filled with the rock removed in sinking the new shaft and in mining on the levels above. A series of winzes, some ten or twelve in number, connect this and the fourth level at irregular intervals. Besides answering the purposes for which they were sunk these serve to test the "ground" between the two levels and show it to be practically free from everything but clean ore. The sixth level has but recently been opened up. Headings are being driven each way from No. 4 shaft, and rooms blocked out at the proper intervals to correspond with those on the levels above. A second dike is encountered here, but only a few feet in thickness and of correspondingly small consequence. The entire force employed under-ground at present on both shafts will scarcely reach two hundred men, the work, as indicated, being confined principally to the completion of the new shaft and the opening up of the sixth level. Everything is in excellent shape, however, for rapid mining when the management see fit to accept the price offered for ore and close their contracts for the season—which, however, they appear to be in no hurry to do. More surface improvements are now in progress than have ever been noticeable at any one time in the previous history of the mine.

Marquette Range:—

At the Samson mine persistent and judiciously directed work has finally obtained its reward in the discovery of a workable body of splendid ore. When the management now in charge took hold of the property, the mine was practically worked out, so far as appearances went, but Mr. Parker was confident that there was ore there yet, and he went to work vigorouly to discover its location. The drill was set to work on the bottom level, and two horizontal holes were driven in different directions without anything of value being encountered. A third hole was then started in a westerly direction. This passed through several feet of chlorite and then encountered ore. It cut 26 feet of fine ore in entirely new ground, the quality which is all that could be desired, assays showing that it runs 70.24 in metallic iron and carries but .065 in phosphorus. Taking the high grade of the ore into account, together with the fact that the deposit lies in ground that has never before been touched, this find is full of rich promise for the future of the Samson, and warrants the belief that it is likely to become a very valuable property.—[Mining News.

Probably one of the finest prospects in the new mines of the Negaunee range is the Queen, located on the southeast quarter of section 5, 47-26. To the east is the South Buffalo, Buffalo and other well-known properties. Ground for a shaft was broken a year ago the 14th of January last, ore being struck at a depth of 125 feet. Since that time development work has been quite rapid. The shaft has attained a depth of 230 feet, two levels started, and a third will soon be commenced. Drifting has been prosecuted to a distance of 145 feet upon the trend of the vein, or deposit, and its width is shown, by crosscuts, to be about two hundred feet. Edward Lobb, of Negaunee, president of the company, informs us that there are really two veins here which he calls the north and south, being separated by about twelve feet of soap rock, and while the ore holds about the same amount of metallic iron in each of them, the one to the north is considerably lower in phosphorus, numerous assays showing it to be a Bessemer. In iron it runs from 61 to 65 per cent., in phosphorus from .019 to .062. Assays made by different chemists were shown us, there being a convincing similarity in all of them. It is noticeable, too, that upon the south vein the ore shows much less phosphorus in the second level than upon the first, which leads to the hope that as further depth is attained the improvement will be sufficient to render the entire product of Bessemer grade.—[Iron Ore.

The Profit-Sharing System.

Mr. Alfred Dolge, proprietor of the extensive felt manufactories at Dolgeville, Herkimer Co., N. Y., has for some years past set apart a portion of the profits of his business for the benefit of his employes. In pursuance of this plan, Mr. Dolge has established a school in order that the young may have the advantages of a thorough education. Mr. Dolge has also introduced a system whereby his workmen, after ten years' continuous service, are entitled to a pension proportionate to the wages earned, in case of inability to work, from accident, sickness or old age. He has in addition made an arrangement by which every employe who has been for five consecutive years in the employ of the firm becomes entitled to a life insurance policy for $1,000, and at the expiration of the tenth year to an additional policy. Those employes who are rejected by the insurance company have an equal amount deposited to their credit in the German Savings Bank of New York. A mutual aid society and a school society have each received large donations from Mr. Dolge. He helps the men to become the owners of their homes by building houses on plans prepared by them, which he allows them to buy and pay for on monthly instalments of $10 each. Mr. Dolge encourages the complete independence on the part of his help, and his system has been found to work very successfully.

A Successful Firm.

A notable anniversary was celebrated Wednesday in the Albany building, 132, 234 and 136 Vine street. It was that of the successful newspaper advertising agency of S. H. Parvin's Sons. That enterprising firm was established in Cincinnati March 27, 1851, and has grown steadily ever since. Since its inception the firm has been doing business with this paper, and the *Enquirer* takes pleasure in saying that its relations with the agency have always been of the pleasantest character, and that the gentlemen connected with it have the strictest regard for business integrity and truthful statement. Their success during such a long period of years is the best evidence that they give the best of satisfaction to their advertising patrons. In their business they have been brought into contact with nearly all classes of business men, and it devolves upon them in many instances to advise their patrons as to where and in what style to advertise: and to their judgment in these matters is their success largely due, as they are noted for their judicious selection of advertising mediums and the novelty of their advertising designs.

They issue a directory of the leading newspapers of the United States and Canada, arranged in convenient and practical form for the ready selection of any particular class of papers—secular, agricultural, mechanical and religious.—[Cincinnati Enquirer.

The Future of Iron.

This product, which, from the immense extent of its uses, and its applications to the true necessities of mankind, would seem properly stable in its very nature, has during the last two decades suffered much from violent fluctuations. At present the iron trade is repor ed to be in rather a depressed condition, which would be worse except for a combination among the manufacturers, which keeps the production down sufficiently to maintain prices on a paying basis. All over the country mills are starting into action and shutting down, a species of restlessness characterizing the outlook. But an increased market is looked for during the next three months, and after the lessons of the past, an improvement that lasts even for that length of time will not be without good effects. The government by its recent operations in ship and ordnance construction has done something to help matters, and probably the same assistance will be rendered during the next four years.—[Scientific American.

Mr. Hartranft's Position.

TO THE EDITOR OF THE IRON TRADE REVIEW:

We notice in your issue of the 28th ult. that Mr. S. H. Hartranft has been placed in charge of the blast furnaces of Brown, Bonnell & Co. This is certainly news to us, as Mr. Davis, who has been with us for years, is still in charge of our furnaces. We think Mr. Hartranft has been engaged by the Mahoning Valley Iron Co. to operate their stack. Yours respectfully,

FAYETTE BROWN,
Receiver of Brown, Bonnell & Co.,
By J. F. TAYLOR, Agt.

YOUNGSTOWN, O., April 2, 1889.

AN interesting portrait of John Burroughs at twenty opens the April *Wide Awake*, as frontispiece; this engraving accompanies Mr. Burroughs's own story of his boyhood, "The Boy John Burroughs; a Glance Backward," telling how he had to struggle for his "schooling." Another excellent piece of biographical and historical work is by an English writer—Mrs. Blathwayt, entitled "Ralegh and the Potato." "A Dash for a Flag," by R. M. Backus, is a spirited story of the Civil War. "The Little Girl of the Okobojo," by Mrs. Clara Doty Bates, is the tale of a great Western river-freshet. *Wide Awake* is $2.40 a year. D. Lothrop Company, Publishers, Boston.

INDUSTRIAL SUMMARY.

New Enterprises:—

IRON AND STEEL.—The Green Forest Iron & Steel Co. has been organized at Lexington, Va., with C. F. Jordan, president; T. E. McCorkle, secretary and treasurer. Minimum capital $50,000. Maximum capital $3,000,000. The object of the company is to build charcoal and coke furnaces at Buena Vista..... The Falls City Malleable Iron & Steel Works, established recently at Louisville, Ky., for the purpose of manufacturing edged tools by a new process, which eliminates entirely the cost of forging, have just made their first run of product, and thus far the process has turned out exactly as the patentees claimed it would. About 20,000 hatchets, axes, adzes, shears and other common tools have been made, and will be on the market within three weeks.....On Tuesday, the 19th ult., a charter was issued to the Pittsburgh Company, of Pittsburgh (charter perpetual), for the manufacture of iron or steel or both, or of any other material, or of any article of commerce, from wood or metal or both; capital $5,000. The directors are Andrew J. Lawrence, William C. King, John F. Scott, Edward H. Ubley and Fred W. Vanosten.....The National Forge & Iron Company, organized at Chicago, some time since, for the purpose of erecting a rolling mill, have secured a very good location for their works at Burnside, which is at Ninety-third street, on the Illinois Central Railroad and the Belt road, with other railroad lines in the immediate vicinity. Contracts for the erection of the buildings and the construction of the machinery have been let.....A charter has been filed in the Recorder's office for the Totten & Hogg Iron & Steel Company. The capital stock is $150,000, divided into 3,000 shares at $50 each. The directors are Nathaniel B., George E., George A. and William C. Hogg and Robert C. Totten. Of the capital stock $135,000 was issued to Nathaniel B. Hogg for the machinery, patents, etc., of the late firm of Totten & Co., foundry men, in the Twelfth ward.—[American Manufacturer, Pittsburgh.....We are told that a party in Virginia, near Clifton Forge, offers to lease for fifty years 20 acres of land on which to build a furnace, and agrees to furnish said furnace all the ore it can use at $2 to the ton of iron. That seems to be a marvelous proposition, and yet we are assured it is a fact. Pocahontas coke can be delivered there at $2.40 a ton. A ton and a half of this to the ton of iron will make $3.60 for fuel, making the cost of ore and coke at $5.60 to the ton of iron. This will bring the cost of making metal less than $9 a ton, and will beat the best record of any Southern furnace, if there is nothing uncertain in the $2 part of it.—[Ironton (O.) Register.

MACHINERY.—B. H. Ryder is building a machine shop and foundry at Troy, Ala.....The Chicago Exhaust & Blowpipe Company is incorporated at Chicago, capital stock $200,000, for the manufacture of dust separators, furnace feeders, iron pipe, exhaust fans and blowers, and all kinds of sheet-iron work; incorporators, W. E. Allington, W. H. Curtis and H. S. Towle.....The Cady Manufacturing Company, of Cleveland, have recently incorporated, and elected as officers R. C. Moodey, President; Frank P. Cady, Vice President, and Irving A. Brown, Secretary and Treasurer. They will engage in the manufacture of machinery and will make a specialty of machines for the working of wire into all its forms.....Recent incorporations: Springfield Electric Light & Power Co., Springfield; capital, $100,000; to furnish electric light, power, and manufacture electric machinery; incorporators, A. L. Ide, G. N. Black, S. D. Scholes.—Excelsior Feed Water Boiler & Purifier Co., Chicago; capital, $100,000; to manufacture feed water boilers and purifiers; incorporators, William J. Goudy, Henry W. Walker and Chase Ferreira.—Steamboat & Steamship Steering Co., East St. Louis; capital, $500,000; to manufacture apparatus for steering vessels and hoisting machinery; incorporators, J. M. Wallace, Wm. H. Godfrey, Wm. T. Mason.—Steam Loop & Separator Co., Chicago; capital, $600,000; to deal in patents, inventions and discoveries connected with the use of steam, and manfacture apparatus connected with the use of steam; incorporators, Walter Burnham, John Davis, Chauncey Keep.

RAILWAY APPLIANCES.—The citizens of Galveston, Texas, are confident of raising the $50,000 required to secure the location of the Santa Fe railway shops.....The Hartwood Switch Company, with a capital of $50,000, will establish a plant at Birmingham, Ala. The company will manufacture the Hartwood switch.....The Standard Railway Signal Co. has been organized at Columbus, O., with J. B. McDonald as president, to manufacture the electric signal of A. Z. Boda.....Incorporated: Chicago Roller-Bearing Car-truck Co., Chicago; capital, $250,000; for the manufacture of car-truck, cars, and running gear; incorporators, W. J. Cooke, L. C. Burgess, and W. M. Baldwin.....The Fowler Steel Car-Wheel Company, of Chicago, have determined to erect a steel plant to make steel by the Robert process, introduced into this country by J. W. Bookwalter. They will make steel exclusively for their rolled steel car-wheels, casting the blanks in a steel foundry which is also to be erected at their works.

Enlargements, Additions, etc.:—

The Chattanooga (Tenn.) Machinery Works are increasing facilities..... The Chattanooga (Tenn.) Tool Works are increasing the capacity of their works by 300 per cent., the addition having been rendered necessary by rapidly increasing orders.....Carnegie, Phipps & Co. are enlarging their wire and nail plant, at Beaver Falls, Pa. The firm has placed an order for 50 machines with the National Machinery Co., of Tiffin, O.....The beam mill at the Homestead Steel Works, Pittsburgh, will be improved so as to turn out 30-inch beams. The armor plate mill at the works is now running double turn, and the structural iron department is equally busy.....St. Louis Shovel Co., St. Louis, Mo., during the past month have doubled their capacity by the introduction of considerable new machinery. They report the outlook as very promising for a large spring trade.....Saturday, the rolling mill shut down, in the puddling department, for probably this entire week. The stop is made to allow of inside improvements, more especially to build a tramway for easily hauling muck iron across the mill from the rolls to the shears.—Warren (O.) Chronicle.....The Duluth Iron & Steel Co., of Duluth, Minn., have let the contract for three 18x60 fire-brick hot-blast stoves to Gordon, Strobel & Laureau, Limited, of Philadelphia, together with other work. The stoves to be erected are of the Gordon-Whitwell-Cowper type.....Alex. Laughlin & Co., engineers and contractors of Cleveland, report under date 28th inst., that they recently furnished the Middleport Steel & Nail Works, with working drawings for a Smith Ingot Heating Furnace, with working hearth 7′x20′, which is now in course of erection. They also sold the Eureka Iron & Steel Works, Wyandotte, Mich., a shop-right for the use of their improvements in furnaces and producers, and furnished them with working drawings of a bar mill furnace 7′x18′, which will be built at once; upon the completion of which they design changing their entire mill to this system.

Fires and Accidents:—

Last week Wednesday a fire occurred at the Fort Pitt Foundry of Macintosh, Hemphill & Co., corner of Thirteenth street and Penn avenue, Pittsburgh. Before it could be brought under control, $60,000 worth of property was destroyed. The loss is fully covered by insurance.....Wood, Smith & Co., Fort Plain, N. Y., announce that a slight fire occured in the foundry department of their spring and axle works on the night of the 19th ult., but that they will be in full operation again in a few days, and that they have a large stock of goods and boxes on hand, there being but little interruption in their business.....The Beaver Falls Iron Co., which was burned out at this place some time ago, are negotiating with the defunct Wampum Wire Mill, and it is evident that the plant here will be removed to that place.—[Beaver Falls (Pa.) Journal.

Failures, Shut-downs and Labor Troubles:—

The strike at the Wheeling Steel Works, at Wheeling, W. Va., which was inaugurated on January 1 last, has finally been settled by the signing of a wages scale substantially the same as that of last year, and the reinstatement of all old employes.....Notices have been posted in the rolling mills of the Columbia Iron Company, at Lancaster, Pa., that after April 6, $3.50 per ton will be paid for puddling iron, and other ton men in proportion. The management say that either a reduction or complete shut-down is necessary. The Penn Iron Company, of that city, have also posted the same notice of reduction .....The employes in the machine shops of the Pennsylvania Railroad Company, at Altoona, Pa., have been notified that hereafter nine hours will be considered a day's work, with a half-holiday on Saturdays. This affects about 4,000 men.

General Industrial Notes:—

I. H. Eller & Co., Canton, O., manufacturers of iron and steel roofing, have lately moved into their new works and are now in good shape to supply the trade. The specialty of this company is the Eller patent lock seam, which has the edges combined by locking the one strip to the other in the standing seam, thereby making one continuous seam from one end to the other, doing away with the separate caps, rivets, eyelets, tin straps, countersinking, &c.; in fact, it overcomes all these objectionable features. This company has only been in business a short time and reports trade fair with the prospects good for the year.....Messrs. E. E. Garvin & Co., manufacturers of machinery, New York, have recently secured a long lease of the new building at Laight and Canal streets, and will fit the same up with all modern appliances. Their new quarters will contain about 45,000 square feet of floor room and will have light on three sides. We are pleased to record this evidence of their prosperity..... After an idleness of about six weeks, the steel tube department of the Riverside Iron Works, at Wheeling, W. Va., resumed operations last week on double turn, giving employment to about 250 men.....Sebastian, May & Co., of Cincinnati, O., are sending out a "sheet" of illustrations of their improved machines. The sheet just received is devoted mostly to lathes, from their 8-inch hand lathe to their new 18-inch power-engine lathe. There are also shown drill-presses, engines and boilers, portable forge, emery grinding machine, &c. .....William Tod & Co., founders and machinists, of Youngstown, Ohio, are building a pair of blooming mill engines for the Chester Rolling Mill Company, at Chester, Pa., which are worthy of special notice. The bed is 30 feet long, and is extended so as to carry the countershaft, all formed from one casting. The cylinders are 30x48 inches, and the two engines are solidly joined together so as to act on the shaft. The links are supported centrally and the reversing gear is controlled by a hydraulic engine.

American Tin Plates.

President O. W. Potter, of the North Chicago Rolling Co., states that one of the purposes which he expects to see accomplished by the consolidation of Chicago steel companies is the manufacture of tin plate. The erection of a special plant devoted to this object is seriously contemplated. The field he considers an inviting one to enter, because tin plate is not now manufactured anywhere in this country, while consumption is enormous, furnishing a large business to the tin plate works of Wales and England. Every other branch of the iron and steel industry has been thoroughly established on this side of the Atlantic, and our productive capacity is in excess of the present demand in almost every line. Mr. Potter believes that the high quality of Lake Superior ores would produce a steel eminently suitable for the production of sheets to be coated with tin. Some of his new associates in the consolidated companies are known to have been very strongly impressed for a long time with the desirability of domesticating the tin-plate trade, and have given the subject much thought and careful investigation.—[Metal Worker.

A MATTER of local iron interest, in Chicago, is the movement of pig iron houses to the Rookery Building. One firm has already gone there, and it is is stated that four or five others will immediately follow. Its roof will cover, it is said, the greatest aggregate of iron and steel interests of any building in the world.

THE RECENT HARTFORD (CONN.) BOILER EXPLOSION.

FIG. 1.—THE PARK CENTRAL HOTEL AFTER THE EXPLOSION.

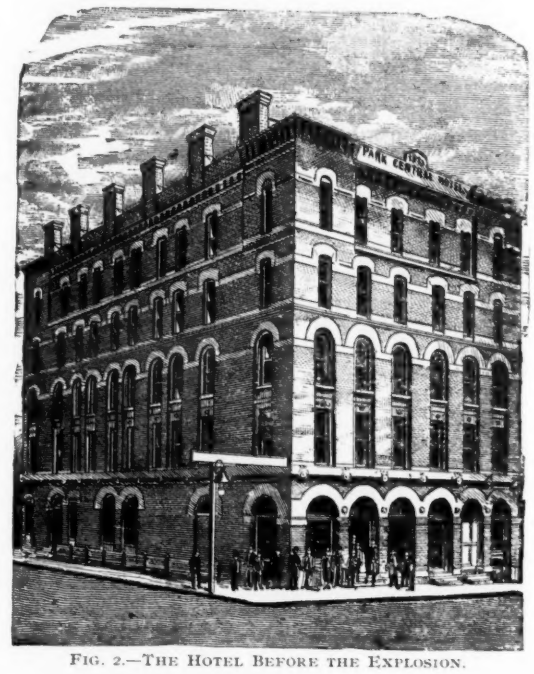


FIG. 2.—THE HOTEL BEFORE THE EXPLOSION.

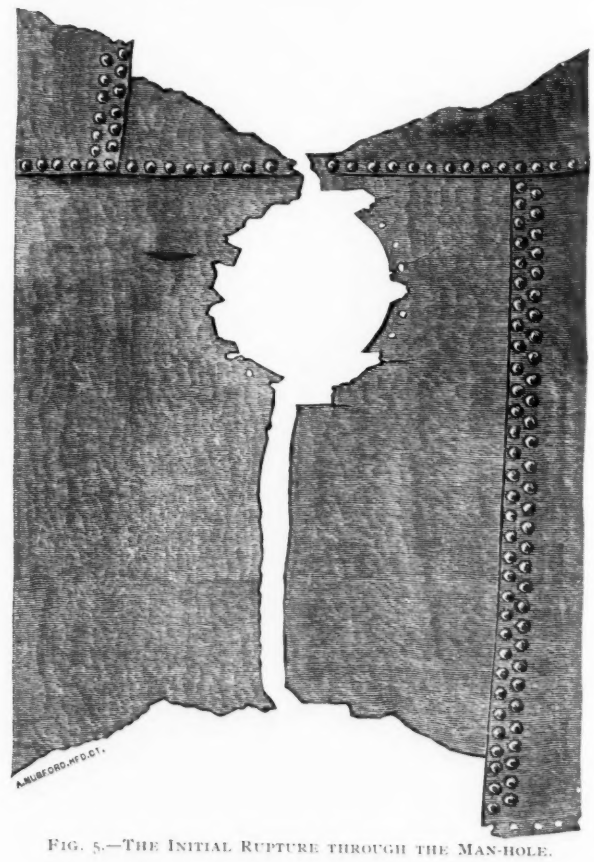


FIG. 5.—THE INITIAL RUPTURE THROUGH THE MAN-HOLE.

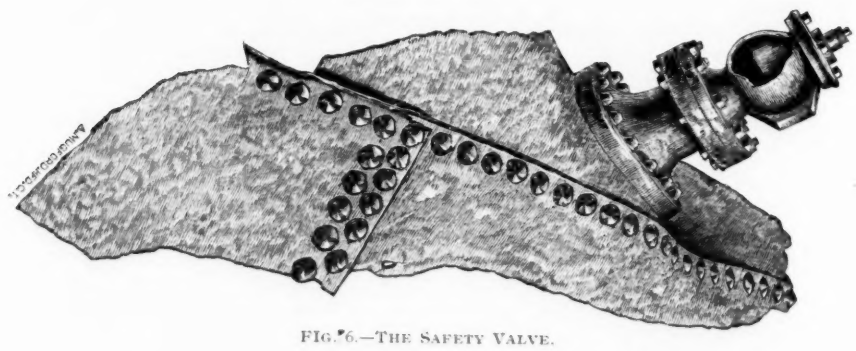


FIG. 6.—THE SAFETY VALVE.

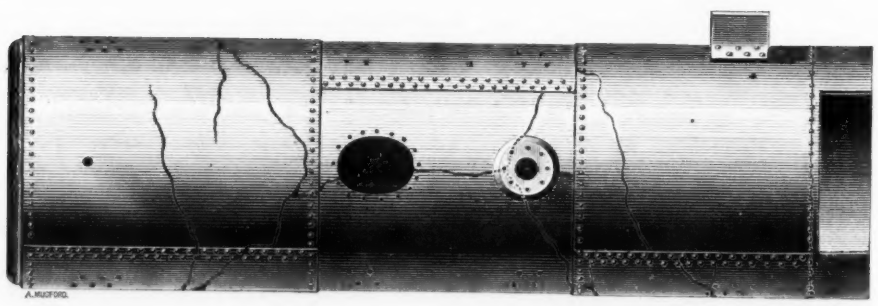


FIG. 4.—PLAN VIEW OF THE RESTORED BOILER.

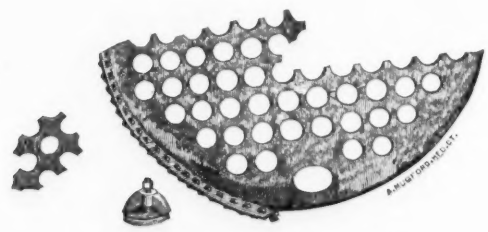


FIG. 9.—LOWER HALF OF BACK HEAD.

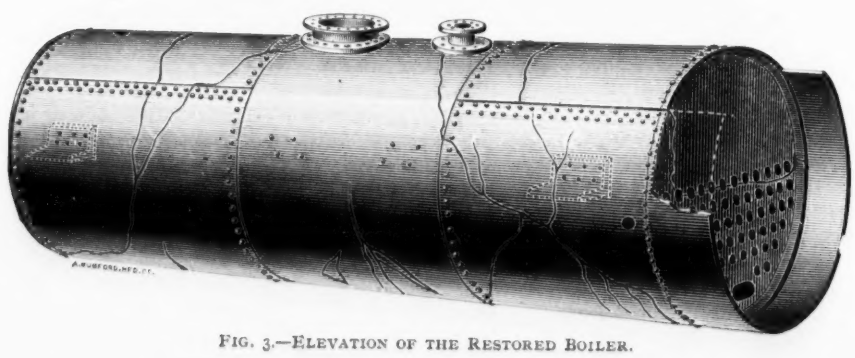


FIG. 3.—ELEVATION OF THE RESTORED BOILER.

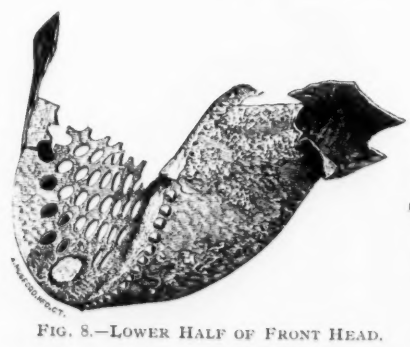


FIG. 8.—LOWER HALF OF FRONT HEAD.

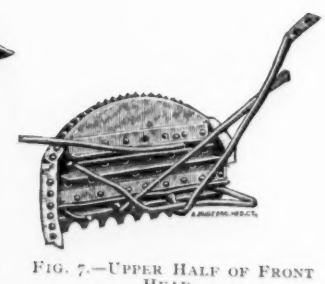


FIG. 7.—UPPER HALF OF FRONT HEAD.

THE RECENT HARTFORD BOILER EXPLOSION.

THE LOCOMOTIVE.

At 4:50 A. M., February 18, 1889, a tubular boiler of about 60 nominal horse power exploded in the cellar of the Park Central Hotel, corner High and Allyn streets, Hartford, Conn., the building, a fine looking five-story brick structure, was completely demolished, and the inmates were buried in the ruins, and the work of rescue began at once, and 10 persons were taken out more or less severely injured and sent to the hospital; while 23 bodies, many of which were so mutilated as to be scarcely recognizable, were sent home and buried by sympathizing friends. In several cases whole families perished. The loss is estimated at $75,000, none of which can be recovered, as the property was covered by fire insurance only, which does not indemnify against loss or damage by explosion. Such was the violence of the catastrophe that the roar and shock of it were heard and felt for miles around the city, and surrounding property suffered a damage of thousands of dollars.

Our illustrations will give the reader a good idea of the appearance and magnitude of the hotel. Fig. 2 shows it as it was before the explosion, and Fig. 1 shows what was left standing of the rear portion of the building. This had afterwards to be pulled down, thus making the destruction complete.

The cause of this terrible disaster was an iron boiler of the horizontal tubular type, about four years old, and of the following dimensions: diameter 54 inches; length 16 feet, 3 inches; shell plate of Bay State refined iron, 5-16 inches thick, double riveted; heads (iron, ⅜ inches thick; tubes 3 inches in diameter, 15 feet long and 58 in number. Two engineers were employed, one of whom has held a marine license; one of them stood watch by day, the other by night. The boiler was inspected annually by the State Inspector of Steam Boilers, First Congressional District, and was last tested by hydrostatic pressure in August, 1888, and a certificate given conformably to law, for a steam pressure of 75 lbs. per square inch. It is not true, as was stated in various papers, that this boiler had been inspected by the Hartford Steam Boiler Inspection & Insurance Company. This company had never inspected the boiler in question, nor had it any knowledge of it.

The work of recovering the fragments of the boiler was undertaken promptly after the explosion, and as fast as they were brought out of the ruins they were carefully measured, and the work of re-assembling them was begun. The result is shown in Figs. 3 and 4. It will be readily seen that, although a few small pieces were lost, the five principal pieces into which the boiler separated (see lines of fracture, Figs. 3 and 4) were recovered, and their position, condition, etc., carefully noted; and these tell the story of the explosion.

It was thought at one time, before the wreck was cleared up, that owing to defects and general structural weakness known to have existed in the building, it was possible that the building had fallen first and in its fall had wrecked the boiler; but as soon as the pieces of the boiler were exhumed from the ruins that belief was dispelled, and it was apparent that a boiler explosion was the cause of the calamity, and not the effect.

There was some diversity of opinion as to the cause of the explosion, but it was thought from the first, by the representatives of this company, that there was no evidence of low water, nor any appearance of over-heating upon the shell plates or heads. This opinion was fully sustained by the subsequent discovery of the back head of the boiler with the fusible safety-plug still unmelted.

The shock of the explosion (which was felt for miles around the city) and the general destruction of the hotel and injury to adjoining property, must, of necessity, have arisen from the release of a very considerable force; and this force we believe to have been the stored energy in the water contained in the boiler at the time of the explosion, the approximate amount of which we will endeavor to compute from the available data. In view of all the facts that have been brought out by investigation since the explosion, we are of the opinion that it cannot be accounted for upon any other hypothesis than that of a pressure greatly in excess of the seventy-five pounds allowed by the State Inspector's certificate—how much greater, is a matter of conjecture. The steam guage, one of the Bourdon patent, was found in the ruins in a dismembered condition (unfortunately it had been so badly shattered as to be of little service in unraveling the mystery), but it was noted that the steam tube or Bourdon spring had been straightened out so as to receive a permanent set; and there were no indications that this had resulted from any other cause than a high pressure. As Bay State refined stamps were found upon the plate of the boiler, it will, perhaps, be fair to assume it to have been of the tensile strength usually accorded to that quality of iron plate; that is, 45,000 lbs. per square inch of sectional area. This, in a boiler of 5-16 inch thickness, double riveted, and 54 inches diameter, would give a safe load of 104 lbs. (see United States Steamboat Inspector's Manual, p. 76) and a bursting pressure of some 375 lbs. The steam nozzle and man-hole of this boiler were placed upon the same sheet, the openings being 8½ inches, and 12½ by 16½ inches respectively. It will be apparent from a study of the illustrations that this portion of the shell would not be as strong as other parts of the shell of like area. Under an excessive pressure the longitudinal section of the middle part in the line of the man-hole opening would be the weakest, and there would be a distortion, as it flattened down in assuming an oval shape under a gradually increased pressure, from a concentration of the strain at that part. That this was the case seems demonstrated by the drawing down of the plate on that line; for this was the only place, so far noticed, where there was any perceptible reduction of thickness in a plate along the line of rupture. This strain would have to be withstood by the man-hole frame; and when that fractured, the opening being so close to the edge of the sheet, rupture and explosion were inevitable. (See Fig. 5.)

The man-hole frame is thought to have been shattered, but no pieces have as yet been found.

If, as we believe, this middle sheet was weaker than the others, a much lower pressure than 375 pounds (the theoretical bursting pressure) would cause rupture. Suppose, then, for the purpose of our computation, that the pressure at the time of rupture was 200 lbs. per square inch, the corresponding temperature being 388 deg. Fahr. It is true that we cannot tell the height of water in the boiler at the time of the explosion with precision, but the fact that the fusible plug was found intact, and that it readily fused when subsequently heated, establishes beyond dispute that there must have been at least enough water to cover it; and our calculation will assume this to have been the case. On making this assumption we find that the boiler contained 5,552 lbs. of water and 48 lbs. of steam. When the explosion occurred a portion of this mass of water was vaporized, the temperature of the remaining water being thereby reduced to 212 degrees. The assumed original temperature being 388 degrees, the fall in temperature was 388°—212° or 106°; and this multiplied by 5,552 lbs. gives 977,150 British thermal units, which is the amount of heat given off and immediately converted into mechanical energy. The difference between the total heat of a pound of steam at the assumed pressure and at atmospheric pressure is 1200°.2—1146°.6, or 53°.6; and this multiplied by 48 lbs., the weight of steam in the boiler, gives 53°.6×48=2572 British thermal units. Now if we add this to 977,150 (the heat given off by the water) we have 979,722 heat units, which is the amount of heat given off in the form of mechanical energy. Since one heat unit is equivalent to 772 foot pounds of energy, the heat given off by the boiler was equivalent to 772×979,722=756,345,000 foot pounds.

This large number of foot pounds means this: The mechanical energy developed by the liberation of the water and steam in the boiler at the temperature due to 200 pounds pressure, was sufficient to raise 756,345,000 pounds one foot; or, if we assume that the boiler and fixtures weighed 6 tons, it would have been sufficient, if applied vertically to the boiler alone, to raise it in the air to a height of many thousand feet.

We may more fully understand the magnitude of the force confined within the boiler by comparing it with the destructive effect of the wind at the time of a violent hurricane that destroys buildings and uproots large trees. The wind, we are told, has a maximum velocity at such times of 100 miles per hour, and exerts a pressure of 50 lbs. per square foot; while in the boiler under consideration the pressure is believed to have been 200×144=28,800 lbs. per square foot.

Many of the most destructive explosions of which we have any knowledge, have been caused by an inoperative safety valve, an accumulated pressure, and a full supply of water in the boiler; indeed the greater the quantity of water at such times, the more disastrous the effect.

There are many stories in circulation as to the want of care and proper management of this boiler. The coroner is now engaged in an investigation, and it is hoped that he may clear up the mystery of the safety-valve, and among other things, tell us whether it was purposely set fast, or became so in some other way. It was of the common lever variety, with a conical valve 3 inches in diameter, and it was amply large, when in working order and intelligently used, to discharge all the steam the boiler was capable of making. Fig. 6 shows the valve as it appeared after the explosion. The observed tendency of a conical vaive to stick in its seat, and the ease with which it may be tampered with, have led to the introduction of various improved safety-valves. Figs. 7, 8, and 9, represent portions of the heads.

The facts that we have outlined seem to justify the following hypothesis: That the fire was not properly banked by the engineer who went off duty at midnight; or that if it was, one of the two tramps who were allowed to sleep in the fire-room, and lost their lives there, had opened the damper and closed the fire-door after the engineer was gone, probably not realizing the danger of the act: that the safety-valve was inoperative and that steam accumulated until the strain on the shell reached the limit of strength of the weakest point, which weakest point is shown by the explosion to have been the man-hole frame and middle course sheet: that the explosion wrecked the partition wall in the cellar, against which the boiler was placed, and that it then raised the building, displacing connecting walls, joints, and supports, drawing them inwardly with the exception of the front wall on High street, which, not being connected, was blown outwardly and fell into the street.

Explosions of boilers similarly placed have not always wrecked the building as completely as this one did, but of course there is the possibility that the other explosions were not so violent. When boilers are placed beneath buildings (and it is impossible to avoid placing them so, in some cases), the result is apt to be very serious in the event of an explosion, for such walls as are not blown down at the time are often so badly shattered that they have to be pulled down and rebuilt. In this case if more of the main walls had remained standing it is probable that beams and other parts would have lodged against them in such a manner as to have saved many of the lives that were lost.

THE April *Century* is a Centennial number, one-half of its pages being devoted to this subject. The frontispiece is a picture by I. R. Wiles, "Washington Taking the Oath as President." The first article is a historical sketch of "The Inauguration," written by Mr. Clarence W. Bowen (Secretary of the Centennial Committee). This is followed by two articles from the pen of Mrs. Burton Harrison: "Washington at Mount Vernon after the Revolution," and "Washington in New York in 1789." Mr. Charles Henry Hart, of Philadelphia, one of the best authorities on this subject in the country, describes the "Original Portraits of Washington," and McMaster, the historian, writes concerning "A Century of Constitutional Interpretation." Besides this profusion of Centennial material, the magazine treats of a variety of subjects, all in its own interesting and instructive way.

WHILE Andrew Carnegie was addressing an audience, in Philadelphia, on Monday night, 3,000 workmen, in his great steel mills at Braddock, were inspecting a splendid public library presented to them by their emyloyer and thrown open for the first time. The building complete cost $125,000, and its shelves and cases contain 2,200 books. It is by such acts as this that Mr. Carnegie has won the admiration and respect of his employes.—[Philadelphia Press.

MACHINISTS' SUPPLIES.

Euchenhofer's Automatic Feeder.

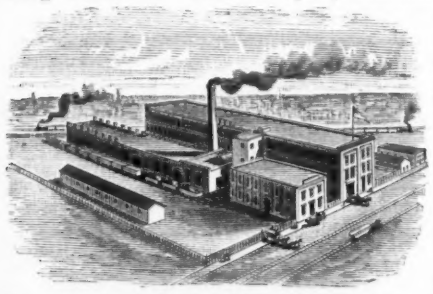
There is nothing of more importance to steam users than to keep their boilers free from the formation of scale, and it is a well known fact that nine-tenths of them use and rely on some scale solvent to prevent this formation. There has, however, been one great trouble connected with the use of scale solvents, and that is, that they could never be introduced into the boilers with good and practical results. They have all been and are yet introduced either by pouring the solvent into the heater; by having an extra arrangement attached to the feed pump and from there pumped over; by putting them through the man-hole when the boiler is being cleaned, or by introducing them through the safety valve. All the foregoing methods have their faults, the principal of which is that the scale solvents are fed into boilers with a gulp; or, in other words, the quantity used is put in all at one time, after which the effects of the solvent are soon lost. Not only this but they clog up pumps, valves and pipe connections. All the foregoing results, it is claimed, can be avoided by the use of Euchenhofer's automatic feeder, the invention of Mr. E. E. Euchenhofer, late chief engineer of the Dayton (O.) Water Works. The secret in using scale solvents so as to give satisfactory results with from 25 to 35 per cent. less material, is to feed regularly and automatically so as to keep the water in the boiler constantly impregnated with whatever is used, so that lime, magnesia, &c., which are held in solution, can be blown off at intervals during the day. This can only be done, it is claimed, with this feeder. Manufactured by Weinman & Euchenhofer, Dayton, O.

Reynolds Bros.' Hand-Cut Files.

Reynolds Bros., Columbus, O., manufacturers of hand-cut files, began business in 1887, and by close attention to the wants of their customers, they have built up a large trade through Ohio, Indiana and Kentucky. Wherever their goods have been used they have given the best of satisfaction. They make all grades and styles of files, such as round and square, half-round and three-square; horse and shoe rasps, flat and round rasps, and others too numerous to mention. A few weeks ago, the building in which Reynolds Bros. carry on their business was partially consumed by fire, entailing a loss to this firm. Business was stopped for about one week, but they are now in full blast, and are prepared to fill all orders as fast as they come in. They employ 15 workmen, and turn out 175 dozen files per week. We show herewith a cut, representing the teeth of hand-cut files, and also the machine cut, in order to give file users an idea as to the difference in the teeth. For further particulars, address Reynolds Bros., 138 and 140 North Water street, Columbus, O.

Drills, Chucks, Grinding Machines, Etc.

The Standard Tool Co., Cleveland, have lately moved into their new works, which are situated on Garden street extending back to the Cleveland & Pittsburg Railroad. This company's buildings are very substantial, and are all of brick. The dimensions of the main building are 168x40 (five stories); office and shipping rooms, 85x35; engine and boiler room, 40x140; blacksmith shop, 116x25. The works are connected with a switch 300 feet long. They have the best of shipping facilities. The works are all heated by the Huyette & Smith system. A fine 100 H. P. engine, built by the Buckeye Engine Co., of Salem, O., furnishes the power. The officers of the company are as follows: C. W. Bingham, President; H. P. McIntosh, Secretary and Treasurer; E. C. Palmer, General Manager. The more recent specialties of the company are their patent twist drill grinding machine, and "Ellenwood patent drill chucks." They can also supply promptly all kinds of twist drills, reamers, taps, milling cutters and special tools.



American Mining Machinery in the Transvaal.

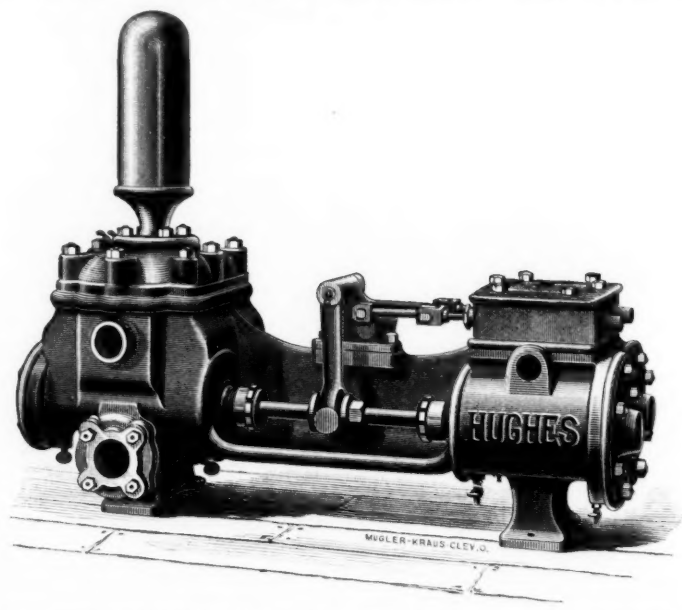
In a report to the State Department, just published, United States Consul Geo. F. Hollis, of Cape Town, South Africa, says:

The two leading manufacturers of mining machinery represented in the district visited were Messrs. Frazer & Chalmers, Chicago, and Sandycroft, England. The merits of each seem to be about equal in the opinion of engineers and superintendents with whom I talked. Manufacturers in the United States are at present handicapped, in their efforts to introduce their productions into this region, by the cost and difficulties of transportation. I have already shown how rapidly the formation and flotation of companies is brought about. The same desire to "push things" obtains in their efforts to bring to light the golden treasures that they know are theirs. They will thus often seek the nearest market, even when they know they must purchase an inferior article, which must eventually be replaced by better when further established. At present American machinery must be sent to England and transshipped to to the Cape line, incurring the double risk of breakage and loss and making a journey of about 9,000 miles with its consequent heavy cost of freight. Sailing vessels are out of the question for goods urgently wanted. A merchant has just informed me that goods ordered last April are still on the water. Could we have a regular line of steamers established between some port in the United States and the Cape, I have no doubt our manufacturers would reap a rich harvest. From indications already apparent I have not reason to doubt the discovery of rich alluvial diggings in the near future, which will be sure to attract a tide of immigration as great, perhaps, as that which took place in California.

THE HUGHES STEAM PUMP.

One of the rising Cleveland enterprises, in the hands of pushing and practical young men, is the Hughes Steam Pump Co., a type of whose pumps is herewith illustrated.

In the manufacture of all their pumps they use only the very best of material, and employ only the most skilled workmen. Their patterns are all of the very latest designs, and so modeled as to produce the greatest strength, without having excessive weight or clumsiness in appearance. They claim for their pumps that they are unexcelled for efficiency, certainty of action, durability or simplicity of construction. All their pumps are made to standard gauges, so that all parts are actually interchangeable, and will fit without being filed or chipped. All the piston heads are fitted with rings or packings of the most approved designs for the work required. The main steam valve in all their single pumps is the ordinary flat side valve, and with their patent valve motion is most simple and effective, being so positive that the pump will travel at any desired speed, and will not vary with or without load. The mechanical connection between the main piston and its valve is such that the valve always leads the piston, so that it is impossible for it to pound on the cylinder heads, and at the same time the clearance in the cylinder is reduced to a minimum. Their pumps are so constructed that they cushion at each end of the stroke, and for a short distance the speed of the piston rod slackens gradually, and this prevents shock or jar. The speed of the piston slackens for such a short distance that it does not decrease the capacity of the pump. In this manner the manufacturers positively guarantee to work the largest pump at the highest speed, and under the greatest pressure without shock or jar. The water valves are of ample area and of very easy access, the water end of the pumps being very large. The water valves may be rubber, hinge, disk or ball valves, and they can be easily removed and have ample strength for the work required.



American Railway Builders in Chili.

James W. Romeyn, United States Consul at Valparaiso, Chili, in a recent report to the State Department, says:

The most interesting feature I have to report on this occasion in connection with United States affairs here is the letting of a Government contract for the construction of about 1,000 kilometers (621 miles) of railway to an American syndicate. The contract price is about £3,500,000 ($17,010,000,) but, unfortunately, the agreement has been seriously affected by a sudden and unexpected advance in the price of exchange on London. When the contract was signed exchange fluctuated between 25 and 26 pence, but since then it has touched 30 pence, and is now fluctuating between 28 and 29 pence. It is estimated that an exchange of 30 pence would cause a loss to the contractors of about $3,000,000, and negotiations on an exchange basis to provide against a contingency have been opened between the representatives of the syndicate and the Government. It is understood that the President of the Republic is desirous of making equitable concessions, and if this matter can be satisfactorily arranged, there will be nothing, after the stipulated security of $1,000,000 for the fulfillment of the contract is deposited in this country, to hinder the contractors from commencing operations at once. The rolling stock for the new lines is to be mostly of American pattern, and, therefore, the probabilities are that this class of materials will be mostly procured from the United States. The fact and these circumstances would seem to invite the attention and enterprise of our unequaled car-builders.

FOREIGN COMMENT.

An Iron Syndicate in Russia.

The pig iron consumers in the West Russian Vistula district, with a view to checking the exorbitant demands of the pig iron producers in that country, have formed themselves into a syndicate. The production of pig-iron in Russian Poland has so much increased of late that the consumers' syndicate has some chance of success.

The Elba Iron Mines.

We understand that the output of the Elba iron mines showed a slight falling off last year, owing to the onerous conditions imposed on the concessionaire by the Italian Government, which granted the right of working the mines a short time ago, to Mr. Joseph Tonietti, of Rio Marina. The labor in the mines is performed by 760 hands—namely, 560 free miners and 200 convicts, the former receiving about two francs a day, and the latter 76 centimes, besides bread for 25 centimes. The Government supplies tools, and steam power is used for washing the mineral. The price of the ore has remained stationary for some time at five to eight francs per ton, according to quality.—[Iron & Steel Trades Journal.

Dull Iron Markets in France.

In the midst of the general activity and upward tendency of prices in the iron and steel industries, the continued weakness and sluggishness of the French iron and steel markets are remarkable. The position is described as a state of crisis resulting from the diminution of demand. One establishment which has been accustomed to supply 20,000 tons per annum to Paris, has lately been supplying at the rate of only 2,000 tons per annum, and the demand for other towns has fallen off to an equivalent extent. The public works are not being pushed on. Works which were begun ten, twelve, and even fourteen years ago are not yet completed, although the materials required were ordered when the work was begun. Hence it happens that the same works forward on the same day material invoiced at 240 f. per ton, and identical material sold since the old contracts were taken, at 110 f. per ton. The metallurgical output has been greatly increased, but the consumption has not kept pace with it.—[London Iron & Steel Journal.

Artistic Work in Iron.

A lecture was delivered recently at the South Kensington Museum, by Mr. J. Starkie Gardner, on "Iron and Artistic Ironwork." The lecturer began by tracing the development of ironwork used in mediæval architecture, and stated that Greece was the first country that seemed to have shown any appreciation at all for iron as a material capable of artistic use. It was also the first country that discerned the difference between art and ornament. Unfortunately, all we knew of Greek art in iron work was from Roman and Greek historians and geographers who traveled during that period. We found them, one after another, speaking in the most rapturous terms of the ironwork of Greece, and comparing it in value to the work in gold, silver and ivory. We must therefore recognize the fact that the Greeks were very expert blacksmiths. Of Roman ironwork we had the most complete knowledge. They revivified the work, and brought it nearer to the use we make of it at the present time. Britain, about the fifth century, was conquered by the Saxons, and the latter found that art in ironwork already existed in this country. We had examples of what early British ironwork was like in Guildhall and other places in London. The difference was in no respect great from that of Rome, except that the Britons were rather more expert than the Romans.—[Glasgow Engineer.

Refrigerating Machinery.

At a general meeting of the Engineering Society of King's College, London, held on the 12th inst., the president in the chair, Mr. Jones read a paper on "Refrigerating Machinery." The author confined his attention to machines based on the compression system, and on the cold-air system. In the compression system, he said, vapor is drawn off from a volatile liquid into a pump and compressed, and the heated compressed vapor is then cooled in coolers or condensers and thereby liquified, and is then ready to be re-evaporated. One of the other machines of Messrs. Siebe, Gormond & Co., which works with a vacuum of 12 lbs., was then described. The ammonia machines on the De la Vergne system, and a 25-ton ice-making plant were also described. The latter machine was made by the Pulsometer Engineering Co., under the Paplett patents. The leakage of ammonia from the compressor pump was entirely prevented by a circular chamber in the stuffing box filled with oil, whereas in the De la Vergne system the same result was produced by pumping oil into the compressor pump below the ammonia. The principle of cold air machines was that, when air is compressed, cooled after compression, and allowed to do work as it expands, cold is produced. The author described in detail Lightfoot's universal refrigerators, and two of these machines on board the steamship *Fifeshire* were alluded to in connection with the frozen-meat traffic. In referring to some of the Haslam machines, the author pointed out the special features of the interchanger system. The author dwelt especially on the application of cold-air refrigerators in bringing fruit from the Colonies. Special mention was made of the employment of a Paplett ammonia machine on board the *Ice King*. Several photographs and a model of a cold-air machine, lent for the occasion, were shown.—[Iron & Coal Trades Review.

The Tempering of Steel.

Mr. Thomas Turner's course of six lectures on "Steel," which he has delivered at the Mason's College, Birmingham, was concluded last week. The last lecture was mainly devoted to the hardening and tempering of tool steel, which, Mr. Turner observed, was an art, the proper practice of which only came with long experience and careful observation. Probably in this country, more good steel was spoiled by improper treatment than was used by the workman. So far as the theory of hardening was at present understood, it appeared to depend on the fact that what was usually known by the chemist as combined carbon existed in two modifications, called tempering carbon and cement carbon respectively; the first of these conferred hardness, and could be produced from cement carbon by heating the metal and then rapidly cooling. Steel when hardened expanded, though, as the tendency was for expansion to proceed at right angles to the length of the piece, in some cases the expansion was accompanied by a decrease in length, and a more than corresponding increase of thickness. This expansion of the metal set up considerable strains in the hardened steel, so that if the operation of hardening were not carefully performed, the tool might be spoiled by the production of water-cracks. To prevent these, as far as possible, the heating should be uniform, and the temperature carefully regulated. High carbon steels required most care in hardening, as they were very easily over-heated and spoiled. Hence a hard steel should not be used when a softer variety would answer the same purpose. If too high a temperature were used the grain of the steel was opened unduly, and the metal was spoiled, but if the temperature was put too low the metal was not hardenetd hrough. Usually the object was to harden through, but not to unduly open the grain. A number of specimens were exhibited illustrating proper and improper treatment of good quality steel, and as examples of the different processes employed for various purposes the lecturer described the production of anvils, files, saws and small steel instruments. When thus hardened steel was too brittle for many purposes, and had therefore to be tempered. Usually tempering was accomplished by heating the hardened tool, after the surface had been roughly polished, until a suitable temperature had been attained, when the metal was plunged in water. The workman judged of the temperature by the color of the film of oxid which formed on the clean surface of the steel, and the higher the temperature employed in tempering, the deeper was the color produced, and the softer and tougher was the product. For special best work, however, it was usual to heat in a bath of lead or oil raised to a suitable temperature.—[Iron & Coal Trades Review (London), March 22.

Edison's New Method of Separating Iron Ore.

A dispatch from Reading, Pa., to the *Public Ledger*, March 24, says: "Many iron men and others continue to flock to a secluded section of Washington township, this county, where experiments are soon to be made with one of Edison's greatest and most recent inventions, known as the Edison Concentrator, the object of which is to concentrate the real ore dug from a mine and get rid, by mechanical means, of all dirt and earthy matter that interferes with smelting. This machiue has been successfully tested in Mr. Edison's laboratory. It is claimed that it will reduce immensely the cost of smelting and bring into use ores that cannot now be profitably worked. New York capitalists have purchased eight acres of iron ore land, where the experiments will be made. Building and machinery are now being put up at a cost of $35,000. The invention, it is believed, will work a revolution in the iron trade. The working of the ore concentrator is not to be a secret as supposed. The rock containing the ore, after passing through the crusher and broken to the size of an egg, is dumped into a large hopper. From here it drops down an incline within a few inches of a powerful magnet. This will be so heavily charged as to draw the ore from its course into one channel, and the rock and other foreign elements contained in the ore are permitted to pass through another channel into the refuse pile."

Strain on Pipes.

Some experiments recently made on the strength of bent pipes have developed some things not commonly known, or, at least, not recognized. We mean the strain on the inside of the angles, due to the effort of the pipes to straighten themselves under pressure. The problem is one of considerable intricacy, resolvable, however, by computation, and is a good one for practice by our engineering students. In the experiment referred to, a copper pipe of 6¾ in. bore, $\frac{3}{16}$ in. thick, was used. The angle was 90 degrees, and the legs about 16 in. long from the center. At a pressure of 912 pounds to an inch, the deflection of the pipe was nearly ⅜ in. showing an enormous strain on the inner side, in addition to the pressure. A steam-engine indicator is made in England on this principle. There is a curved pipe employed, and the tendency to straighten, nnder pressure, produces the recording movement.—[Industry.

The Oldest Iron.

The oldest pieces of wrought iron now known are probably the sickle blade found by Belzoni under the base of a sphinx in Karnac, near Thebes; the blade found by Colonel Vyse, imbedded in the masonry of the great pyramid; the portion of a cross-cut saw exhumed at Nimrod by Mr. Layard—all of which are now in the British Museum. A wrought bar of Damascus steel was presented by King Porus to Alexander the Great, and the razor steel of China for many centuries has surpassed all European steel in temper and durability of edge. The Hindoos appear to have made wrought iron directly from the ore, without passing it through the furnace, from time immemorial, and elaborately wrought masses of iron are still found in India, which date from the early centuries of the Christian era.

New Iron Rates.

The rates on pig iron which went into effect on the 1st from Southern producing districts are as follows:

	Birmingham.	Chattanooga.	Sheffield.
Allegheny, Pittsburgh and Wheeling	$4.65	$4.15	$4.40
Chicago and Detroit	4.00	3.75	3.75
Cincinnati	2.75	2.25	2.50
Cleveland	4.00	3.50	3.75
St. Louis	3.25	3.00	2.80
Kansas City and Leavenworth	5.49	5.49	5.04
Louisville	2.50	2.25	2.25

These represent the leading markets.

RECENT "BIG THINGS" IN MACHINERY.

Drop Forgings from a New Metal.

The latest achievement of the Billings & Spencer Co., Hartford, Ct., is the making of drop forgings from "Tobin" bronze, a new metal produced by the Ansonia Brass Co. It is excellent for parts of engines and machinery which are exposed to corrosion, and where greater strength is required than is afforded by ordinary brass or bronze. This company has just added two more drop hammers, bringing the total number now in operation up to forty. They have applied for a permit to erect an addition to their forge shop 410x90, more room being needed for their increasing business, and report a good outlook in their line for the remainder of the year.

Large Engines for Cable Roads.

The contract for the engines for the West Chicago Street Railway Co. has been awarded to the Providence Steam Engine Co., of Providence, R. I. This company is the sole builder of the improved Greene engine, and the preference was given this engine for its rigidity, ability to endure sudden strain, its thorough mechanical design, fine workmanship and continuous economy. The engines will be 2,000 horse-power with wheels weighing 150,000 lbs. It is the purpose of the railway company to erect a model plant, and all machinery entering into its construction will be selected only after the most thorough investigation. It is gratifying to the Providence Steam Engine Co. to know that the order sought them and not they the order.

The Largest Crane in the World.

At the Chatham dockyard there has been a test by the Admiralty of the largest and most powerful crane ever made. The weight lifted was 240 tons, and the range or radius of the crane is 75 ft. 3 in., and its height is 125 ft. In the presence of the Admiral of the yard, the chief engineer, and a large concourse of people, the monster crane took its load, raised it, and turned it round as if it had been a feather. The whole of the work has been carried out by Messrs. Tannett, Walker & Co., engineers, of Leeds, who have in hand an 80-ton crane for the arsenal at Woolwich, and who made the 150-ton cranes in connection with the 4,000-ton hydraulic forging press at the works of Messrs. John Brown & Co. (Limited), Sheffield, and are making similar cranes for Mr. Krupp, the Terni Works, and others.—[Glasgow Engineer.

Very Heavy Machine Work.

The Southwark Foundry & Machine Co., at Philadelphia, are turning out this year some very heavy work. They have just finished four immense duplex blowing engines for the new works of the Pennsylvania Steel Co., near Baltimore. Each engine weighs 755,000 lbs., and under each are two bed plates weighing 63,000 lbs. apiece. These were cast in one piece. The fly wheel, weighing 100,000 lbs.was also cast whole and split afterwards. It is believed that these are the largest blowing engines in the country. There are also now being built here two dry dock plants for the U. S. government navy yards at Portsmouth, Va., and Brooklyn, N. Y. Each plant consists of two centrifugal pumps, and engines to drive them. Each pump is to throw a stream of water 45 inches in diameter, and is guaranteed to discharge 40,000 gallons per minute. Two 1,100 h. p. tandem compound Porter-Allen engines are also being built to work on the same shaft, making a total of 2,200 h. p. These will run the rod mill at the New Castle Steel Works, New Castle, Pa. There has just been built an addition 120x107 feet to the foundry, and when completed it will contain two Sellers power traveling cranes to handle respectively, 30 and 50 tons. Thus it will be seen that activity rules at this large establishment.

The Largest Wheel Made.

The largest wheel of the kind ever made in this country, and probably the largest of any kind, is now in course of construction at the machine shop of the Dickson Manufacturing Co., at Scranton, Pa. It is what is called a sand wheel, and is being made for the Calumet & Hecla Copper Co. of the Lake Superior region. The great wheel will be 53 feet in diameter, and several feet wide, and the Dickson Manufacturing Co. will get $70,000 for it. It is being built around a 20-inch hollow shaft of gun metal, and it will weigh between 150 and 160 tons when completed. When the great wheel is put in place at the copper mines, it will be made to revolve slowly by means of enormous cogs on the surface of its circumference. These cogs are being cast in segments, and will weigh many tons in the aggregate. On each side of the mammoth wheel there will be fifty buckets, each of which will hold about 100 gallons, and these buckets will elevate the washings, and dump them into a sluiceway. After the great wheel has been built up and the finishing touches have been put on, it will be taken apart and shipped. Every piece will be numbered, so that there will be no trouble in putting the wheel together, and it will take eight or ten cars to transport it.—[Tradesman.

CUBAN ORE FOR SOUTHERN STEEL WORKS.

AGE OF STEEL.

The importation of a cargo of Cuban iron ore for Alabama rolling mills may be the small beginning of a business which will finally exercise a wonderful influence on the industries of the South, and for that matter of the entire country. As things now stand, the Southern country is practically debarred from making steel; there are no Bessemer ore deposits within its borders worth speaking of, so far as is known. True, for the present at least, a duty of 75 cents per ton on the imported ore would have to be paid; but that disadvantage would be more than offset by the cheapness with which steel could be made at, say, Mobile or elsewhere along the coast, from good, suitable ore. The immense Warrior coal fields would be at the back of the steel works, within easy reach by rail or river, while the ore could be brought by water up to the very sides of the furnaces, as at English Bessemer steel works. None of the expenses attached to the handling of the ore between mines and furnaces would compare with the present cost of shipping from Cuba to Pennsylvania steel makers.

Of course, after all, nothing may come of the venture; but, on the other hand, it is quite as likely to surprise us with its complete success as to occasion disappointment. From what our Alabama exchanges say there will be no failure of the enterprise through any lack of capital; while as to the quality of of the ore there is no serious trouble anticipated, if any at all. It assays from 63 to 68 per cent. metallic iron, and occurs in the neighborhood of Cubanas, about eighty miles from Havana, on the northwest coast of Cuba. The remainder of the connected details is suggested by the quotation to which we here give place: "This property, in fact, consists of a solid mountain of valuable Bessemer ore, over 3,000,000 tons of which lie absolutely on the surface. The mountain is 500 feet high; the ore is inexhaustible. As is known, there is no finer steel-making ore in the world than that of Cuba, and the gentlemen referred to are satisfied they can, by bringing this ore to the Alabama coast, where coal can be the most readily procured, manufacture the finest quality of steel at a cost hitherto unknown in this country."

We may add, paranthetically, that the parties importing the ore are the founders of the new business of exporting Alabama coal to Cuba, where they find a "clamorous" market.

Compounding High Speed Engines.

Recent developments in the direction of compounding high speed engines are attracting marked attention from steam users as a step in the direction of higher efficiency without sacrificing the recognized advantages of compact power driving direct to dynamos or other rapidly rotating machinery. A new feature in this development, which will be watched with interest, is the use of this type of compounds, without the condenser, in localites where cheap water for condensation is not available. It is believed that high steam pressure, expanding through two cylinders, will effect a clear saving that will more than justify the small additional expense of compounding. Acting on this belief, Mr. C. J. Field, general manager of the Edison Electric Illuminating Co., of Brooklyn, and formerly chief engineer of the Edison United Manufacturing Co., has selected this type of engine for the mammoth central station now being erected at 360 Pearl street, Brooklyn, where the energy of 3,000 H. P. will be sent out in electric currents, through an underground system, radiating through nearly a mile in all directions from the station as a center. The engines, for this work, will be furnished by the Ball Engine Co., of Erie, the order having been placed with their New York agent, C. R. Vincent & Co., No. 15 Courtlandt street, for twelve engines each 250 H. P. capacity. The general plan of these engines will be of the double horizontal type with opposite cranks and one high pressure and one low pressure cylinder. Each engine will weigh about 30,000 pounds, thus making twelve full carloads for the engine equipment of this station. Steam will be supplied at 125 pounds pressure by a battery of Babcock & Wilcox boilers, situated on the same floor with the engines. With an electrical outfit embodying all of Mr. Edison's latest improvements in central station work, it is the expectation of the projectors of this enterprise that they will have the most economical and efficient station that has yet been erected.—[Electrical World.

Charcoal Fuel for Furnaces.

In talking with Mr. James E. York, who is spending a few days in the city, recently, he spoke of the amount of labor which the two charcoal blast furnaces were creating in Northern Wisconsin. To illustrate the magnitude of the work required, he gave as the chief item of the past Winter's work the fact that there had been cut and hauled to the coal kilns fully 100,000 cords of wood, viz.: For the York furnace, at Black River Falls, 45,000 cords, and for the Ashland furnace 55,000. This immense pile of wood had to be taken from nearly four thousand acres of land, and it is chiefly hard wood, the chopping undoubtedly extended over considerably more surface than this. This pile of wood has been handled with teams, and will weigh fully 275,000 tons. As the output is designed to furnish the charcoal for but one year's run, it will be seen at a glance that even these two furnaces alone will, in a few years, clear up a large space in the forests of the northern slope. As the land which produces hard wood is generally rich and productive, it will soon be occupied by farmers and thus utilized. These two great furnaces, besides furnishing work and wages for the people, are thus clearing up and settling the country.—[Ashland (Wis.) Press.

The Pressure Exerted by Twist Drills.

Mr. L. B. Breckenbridge, the instructor in mechanical engineering in the Lehigh University, U. S. A., has lately been making some experiments for the determination of the pressure exerted in drilling cast iron. He made a cylinder in which was a plunger, having an area of ten square inches. Three small grooves were turned in the plunger near its lower end, so as to prevent any leakage of the oil with which the cylinder was partly filled. Two holes were drilled in the cylinder near the bottom, and a steam gauge and an indicator were attached. The indicator cord was attached to the hub on the shaft of the quick return motion lever, in order to obtain diagrams of considerable length. When the piece to be drilled was resting on the plunger, a diagram could be taken which would show the pressure exerted in forcing the drill through the work. With ¼-inch twist drills the greatest downward pressure was 400 pounds; with ½-inch, 900 pounds; with ¾-inch, 1,100 pounds; with one-inch, 1,450 pounds; and with 1¼-inch, 1,800 pounds.—[Industries.

A BUSINESS man may plant like Paul and water like Apollos, but he must depend on the well regulated and widely circulated newspaper for his increase. —[Ohio Valley Manufacturer.

CONDITION OF PITTSBURGH'S IRON AND STEEL BUSINESS.

NATIONAL LABOR TRIBUNE, APRIL 6.

Just before the *Labor Tribune* went to press, the representative of this department made a quick trip and a short visit to thirteen mills all along both sides of the Monongahela river. Everything was found to be very encouraging, with excellent prospects for the future, but with some very discouraging feeling on the part of some men who always seem to base their ideas upon wrong impressions, which in this instance are founded on the stock of raw material. It is true that there is more muck iron on hand now than usual, and, while the amount is still increasing, there is no falling off in the work. The yards of the Soho mill, of the Moorhead-McCleane Co., contain over 5,000 tons of raw iron; one thousand tons or more is rolled into what are called tops and bottoms for heavy plate iron. Both puddling departments of 34 furnaces are on double,turning out about 70 gross tons a day. The finishing rolls are nearly all on single turn, excepting those producing sheet iron, which are run day and night. The net output is over 100 tons a day, one-half of which is steel. The blast furnace connected with this plant produces about 200 tons a day, but a great deal of it is being sold. There being almost no stock on hand is evidence that the company does not anticipate much of an advance on metal. But they seem to be anxious to get as much muck iron as possible. Their stock at the present price is worth $150,000; but as it is nothing unusual for muck iron to advance a dollar or more in a month, and notably after the first six months of the year, they can already count upon a handsome profit upon their investment.

The yards of the Keystone iron mill have over 4,000 tons of muck bars and 3,000 tons of metal, all paid for, which is an investment of more than a quarter of a million dollars. This firm has not turned out a ton of finished iron this year, and only 2,500 tons in the first six months of last year. Their puddlers are still on single turn six heats, and the prospects are favorable for the finishing rolls to be started up, but not until the latter part of next month.

The Elba iron works, at Frankstown, are booming. The word applied suits the present run and future prospects. The puddlers are on double, and with plenty of orders to continue so up to July the first. Meantime it may be possible that the firm may be compelled to buy some muck bars.

The very best outlook in eight week is in Painter's mill; 24 puddling furnaces were on six heats, and now 54 are on double turn. Thirteen are still standing idle, but may be started on double at any day. The large stock of finished iron is all being shipped away, and an immense lot of large coutracts are now being turned out.

The Byers & Co. mill and pipe work are running double, and buying skelps. Zug's will go on six heats this week.

The output of muck iron in the last month is 35,820 tons; in March last year it was 38,133 tons, a difference of 2,313 tons less this year. A year ago the outlook had never been better, and inferring from the above statement, there is no reason to complain. The only feature that may not change is the run of single turn in the puddling department of two mills, and two that are practically idle are looked for to be started up before long. There are now a great mady ironworkers idle, but a year ago there was an unusually large number of (so-called) standing turn men that were to be found in nearly all the mills. At present the largest number is at McKeesport.

Iron-Making in Colorado.

The annual report of the Colorado Coal & Iron Co. for the year ending December 31 says: While the results for the past year have been unsatisfactory, owing to the demoralization of railroad rates at points east of Colorado, which enabled shippers of steel, iron and coal to invade territory that naturally should be supplied from Colorado, we hope and believe that, with adjusted rates outside of this state, with improved business conditions, the change of management and economies which it is proposed to enforce, the results for the next year will be much more gratifying. The following is a condensed statement of the result of the year's operations as compared with the previous year:

	1888.	1887.
Gross earnings, including interest from investments and interest discount and exchange account	$2,219,047.99	$2,822,529.61
Cost of production and manufacture, including taxes, insurance and royalties	1,933,605.89	2,270,295.19
Net earnings	$ 285,422.10	$ 552,234.42
Deduct interest on bonded debt two coupons	209,940.00	209,940.00
Surplus for year	$ 74,503.10	$ 342,294.42
Royalties earned and charged in above expenses		$ 96,245.39
Sales of real estate for the year amounted to		128,341.61

What Killed the Copper Syndicate.

The error of the syndicate was, in making the price of copper too high. Had the general selling price of lake copper been put at 12 cents, and the syndicate basis 10 or 11 cents, and other brands in proportion, the syndicate, though in that event unnecessary, would still be in existence, and the violent and injurious fluctuations we are now having or are likely to have in the price of the metal would have been avoided. The outcome of this wild attempt at cornering the copper of the world has been the utter bankruptcy of the Societe des Metaux, the most important copper manufacturing concern on the Continent; and of the Comptoir d'Escompte, the second largest banking institution in France, and the more or less serious embarrassment of several lesser institutions and individuals.—[Engineering and Mining Journal.

International Congress of Applied Mechanics.

There will be held at Paris, at the Conservatoire des Arts et Metiers, an International Congress of Applied Mechanics, under the patronage of a Committee of Honor, comprising savants and engineers of renown, both from France and from other countries, who will give the work of the Congress the benefit of their influence and the weight of their authority. The President of the Committee on Organization is Monsieur Phillips, Ex-inspector General of Mines (retired). The five members appointed from the United States are, in the order of their mention on the official bulletin: Messrs. Robert Grimshaw, (President Polytechnic Section American Institute, N. Y.); R. H. Thurston, (Director Sibley College of Cornell University, Ithaca); President Egleston, (Columbia College School of Mines, N. Y.); and the Presidents of the American Societies of Civil and of Mechanical Engineers.

At this Congress, among the important subjects submitted for discussion, are the unification of the horse-power; the choice of materials in machine construction; the mechanical production and utilization of artificial cold; transmission to a distance, and distribution, of work, by other means than electricity (water, air, steam, cables, etc.); automatic cut-off engines with several successive cylinders; thermo-motors other than the steam engine.

Other topics, treated by papers, will be improvements in steam engines since 1878; progress among associations of owners of steam appliances; and improvements in apparatus for the generation of steam (more particularly sectional boilers).

The Minnesota Boiler Inspection Law.

A new law will hereafter prevail in Minnesota in testing boilers. Sec. 1, rule 2, proyides that boilers built prior to February 28, 1872, shall be deemed to have a tensile strength of 50,000 pounds to the sectional square inch, whether stamped or not, and shall be tested under the provisions of February 3, of the act relating to boilers built after February 28, 1872: "Any boiler having been in use ten years or more shall, at each annual inspection thereafter, be drilled at points near the water line, and at the bottom of shell of boiler, or such other points as the local inspectors may direct, to determine the thickness of such material, at those points, and the general condition of such boiler at the time of such inspection, and the thickness of said material shall be determined thereafter at each annual inspection, and the steam pressure allowed shall be governed by such ascertained thickness and general condition of the boiler." Heretofore, the inspectors have never been required to drill holes.

Destroying Machinery.

It is a fact that more machinery is destroyed through ignorance and carelessness than by use. Men that are very careful, and even miserly, in their money matters, are often the ones who lose most by bad management and carelessness in regard to the use of their machinery. Indeed, in many cases, the premature breaking down of well made machinery is directly traceable to miserly instincts of the owner, and his unwillingness to employ and pay a competent person to care for and operate it. Of all penny-wise and pound-foolish policies this kind is the least excusable. It often brings undeserved blame and discredit upon the honest manufacturer, which is not compensated by the additional profit he may derive from replacing the worn-out machines with new ones.—[Southern Lumberman.

RAILS in use rust less quickly than those at rest. The preservation of rails in steam roads in use is not the result of vibratory motion, or of an electric action due to the passage of the trains, but to the formation of magnetic oxide, produced by the compression of the rust on the metal. The rails are thus protected against the action of moist air, in the same manner as iron is oxidized by fire.

A BILL before the Minnesota Legislature proposes to lease its mineral lands. The tax on iron ore mined will be 25 cents per ton, the company will have to pay the usual land tax, and 1,000 tons must be mined annually after a road is within a mile of the beds. In five years 5,000 tons must be dug annually.

THE rectangular Palais des Machines building, at Paris, is 1,390 feet long, 150 feet high, and has a glass roof span of 360 feet. There is nothing in the world like it. In the whole structure there are 6,000 tons of iron; cost $700,000

A LOCOMOTIVE to be operated solely by electricity is being built at Rome, N. Y.

LIST OF PATENTS.

Relating to Iron, Steel, Metal, Machinery, Hardware and Mining Interests.

Reported expressly for this paper by H. T. Fisher, (late Ex. U. S. Patent Office), Patent Attorney, 34 Blackstone Building, Cleveland, O.

PATENTS BEARING DATE MARCH 26, 1889.

Clutch, differential speed, J. Brooks, Plainfield, N. J.
Clutch, friction, H. W. Hill, Cleveland, Ohio.
Latch and lock combined, T. Overton, Corpus Christi, Texas.
Machinery, device for preventing the backward movement of, J. A. Allen, Adams, Mass.
Metal, apparatus for compressing scrap, J. W. Summers and T. Sharp, Stalybridge, County of Lancaster, England.
Metal bars, die for upsetting, W. R. Webster, Philadelphia, Pa.
Metals, drawing, W. A. McCool, Beaver Falls, Pa.
Ore separator, T. A. Edison, Menlo Park, N. J.
Slag, manufacture of, S. T. C. Bryan, Birmingham, Ala.
Slag, mechanically treating and annealing, S. T. C. Bryan, Birmingham.

EXPIRING PATENTS.

Relating to the Mechanic Arts. Which Become Public Property April 9, 1889.

Furnished by F. B. Brock, Patent Attorney, 639 F St., Washington, D. C.:

Electro magnetic engine, W. G. Thornton.
Rotary engine, W. Darker.
Breech loading fire-arms, H. A. Schesch.
Gas apparatus, J. H. Steiner.
Hoisting apparatus, J. D. Warner.
Metal turning lathe, J. W. Hyatt, Jr.
Pipe vise, Barwick & Farre.
Machine for making concrete pipes, G. L. Eagan.
Steam water elevator, E. Reese.
Furnace for calcining ores, J. H. Dunstan.

IRON AND STEEL MARKETS.

PIG IRON.

CLEVELAND f. o. b. cars, four months': No. 1 Bessemer, $18 00@18 50; No. 1 Foundry, $17 20@17 70; No. 2 Foundry, $16 20@16 70; No. 1 Gray Forge, red short, $15 20@15 70; No. 2 Gray Forge, neutral, $14 70@15 20; No. 1 American Scotch, $17 20@17 70; No. 2 American Scotch, $16 20@16 70.

CINCINNATI reported by Rogers, Brown & Co.: HOT BLAST FOUNDRY—Ohio and Southern Coke No. 1, $15 25@15 75; Ohio and Southern Coke No. 2, $14 50@15 00; Ohio and Southern Coke No. 3, $13 75@14 25; Ohio Soft Stone Coal No. 1, $15 75@16 50; Ohio Soft Stone Coal No. 2, $14 75@15 50; Mahoning and Shenango Valley, $16 50@17 00; Hanging Rock Charcoal No. 1, $21 00@22 50; Hanging Rock Charcoal No. 2, $19 00@22 50; Tennessee and Alabamba Charcoal No. 1, $18 00@18 50; Tennessee and Alabama Charcoal No. 2, $17 00@18 50. FORGE—Strong Neutral Coke, $13 25@13 50; Mottled Neutral Coke, $12 75@13 25; Cold Short Coke, $13 00@13 50. CAR WHEEL AND MALLEABLE—Southern Car Wheel, $20 00@25 00; Hanging Rock Cold Blast, $22 00@25 00; Lake Superior Malleable and Car Wheel, $22 00@23 00.

CHICAGO reported by Rogers, Brown & Co.: COKE AND BITUMINOUS COAL FOUNDRY—Ohio Hanging Rock Softeners No. 1, $18 00@18 50; Ohio Hanging Rock Softeners No. 2, $17 00@17 50; Ohio Hocking Valley Softeners No. 1, $18 00@18 50; Ohio Hocking Valley Softeners No. 2, $17 00@17 50; Ohio Hocking Valley Silvery Pure No. 1, $17 00@00 00; Ohio Hocking Valley Silvery Pure No. 2, $16 00@00 00; Ohio Black Band, $19 00@19 50; Ohio Jackson County Softeners No. 1, $18 00@18 50; Norton and Ashland Brands Ashland, Ky. No. 1, $17 00@17 50; No. 2, $16 00@$16 50; Southern Coke Foundry No. 1, $16 50@17 00; Southern Coke Foundry No. 2, $15 75@16 25; Southern Coke Foundry No. 3, $15 25@15 75; Southern Coke, Soft No. 1, $15 75@16 25; Southern Coke, Soft No. 2, $14 50@15 00; Southern Coke, Grey Forge, $14 50@15 00; Local Furnaces at Chicago and Milwaukee No. 1 Foundry,$16 00@17 00; No. 2 Foundry, $15 00@16 00; No. 3 Foundry, $14 00 @15 00. CHARCOAL FOUNDRY—Lake Superior No. 1 and 2, $20 00@00 00; Hanging Rock, $21 00 @23 50; Southern, $19 50@20 50. CAR WHEEL AND MALLEABLE—Standard Southern No. 3 to 6, $20 50@25 50; Lake Superior, $20 50@21 00; Hanging Rock Cold Blast, $24 50@27 00; Hanging Rock Warm Blast, $22 00@24 00.

LOUISVILLE reported by Geo. H. Hull & Co.: Southern Coke No. 1 Foundry new classification, $14 75@15 25; Southern Coke No. 2 Foundry new classification, $14 25@ 14 75; Southern Coke No. 3 Foundry new classification, $13 75@14 25; Grey Forge, $13 25@13 75; White and Mottled, different grades, $12 75@13 25; Silver Grey, different grades, $13 00@13 50; Southern Charcoal No. 1 Foundry, $16 25@16 75; Southern Charcoal No. 1 Mill, $14 75@15 25; Southern Car Wheel, Standard brands, $21 75@22 75; Southern Car Wheel, other brands, $18 00@19 50; Hanging Rock Coke No. 1 Foundry, $15 50@16 00; Hanging Rock Charcoal No. 1 Foundry, $19 50@ 21 00; Hanging Rock Cold Blast, $20 75@23 75; Hanging Rock Warm Blast, $00 00@00 00.

ST. LOUIS reported by Rogers, Meacham & Shields: HOT BLAST COKE AND CHARCOAL—Southern Coke No. 1, $15 50@16 25; Southern Coke No. 2, $15 00@15 50; Southern Coke No. 3, $14 50@15 00; Southern Grey Forge, $13 50@ 14 00; Southern Charcoal No. 1, $18 00@18 50; Southern Charcoal No. 2, $17 00@18 00; Missouri Charcoal No. 1, $16 00@16 50; Missouri Charcoal No. 2, $15 00@16 00; Ohio Softeners, $18 00@ 20 00. CAR WHEEL AND MALLEABLE IRONS—Lake Superior, $20 00@22 00; Southern, $19 00@ 24 00. CONNELLSVILLE COKE—East St. Louis, $4 70; St. Louis, $4 85.

DETROIT reported by William F. Jarvis & Co.: Lake Superior Charcoal, all Numbers, $19 50@20 00; Lake Superior Coke, all Ore, $18 75@19 25; Lake Superior Coke, Cinder Mixed, $17 75@18 25; Standard Ohio Black Band, $18 75@19 25; Southern No. 1, $17 00@ 17 50; Southern Gray Forge, $15 00@15 50; Southern Silvery, $16 50@17 00; Jackson County Ohio Silvery, $18 25@18 75; Old Wheels, $18 50 @19 00.

PITTSBURGH reported by A. H. Childs: No. 1 Foundry, $16 25@16 50; No. 2 Foundry, $15 25@15 50; Gray Forge, $14 25@14 50; White and Mottled, $13 75@14 00; Warm Blast Charcoal, $18 00@21 00; Cold Blast Charcoal, $22 00 @25 00; Bessemer, $16 50@17 00.

MERCHANT IRON AND STEEL.

Flat Bar.

1½ to 4 by ⅜ to 1 inch	1 70
4¼ to 6 by ⅜ to 1 inch	1 80
1¾ to 6 by 1⅛ to 2 inch	2 10
1¼ & 1⅜ by ⅜ to ¾ inch	1 80
1 & 1⅛ by ⅜ to ¾ inch	1 80
⅝, ¾ and ⅞ by ⅜ to ⅝ inch	2 20

Round and Square.

1 to 1⅞ inch	1 70
2 to 2⅝ inch	1 90
2¾ to 3¼ inch	2 20
3⅜ to 4 inch	2 70
4¼ to 4½ inch	3 20
4¾ to 5 inch	3 40

Oval.

⅞ to 1¼ inch	2 10
⅝ to ¾ inch	2 30
½	2 50
⅜	2 90

Half Oval and Half Round.

1½ to 3 inch	2 80
⅞ to 1¼ inch	2 40
⅝ to ¾ inch	2 90
½	3 20
⅜	4 70

Heavy Band.

½ to 6 by ¼ and 5-16 inch	1 95
1 to 1⅜ by ¼ and 5-16 inch	2 05
¾ to ⅞ by ¼ and 5-16 inch	2 25
½ to ⅝ by ¼ and 5-16 inch	2 75

Hoops.

1¼ to 4, Nos. 13 to 15	2 55
1¼ to 2, Nos. 16 to 18	2 65
1¼ to 2, No. 19	2 75
1¼ to 2, No. 20	2 85
1¼ to 2, No. 21	2 95
1¼ to 2, No. 22	3 95
15-16, 1 and 1⅛, Nos. 13 to 15	2 75
15-16, 1 and 1⅛, Nos. 16 to 18	2 85
15-16, 1 and 1⅛, Nos. 19 and 20	2 95
15-16, 1 and 1⅛, No. 21	3 05
15-16, 1 and 1⅛, No. 22	3 25
⅞, Nos. 13 to 15	2 95
⅞, Nos. 16 to 18	2 05
⅞, Nos. 19 and 20	2 15
⅞, No. 21	3 25
⅞, No. 22	3 35
13-16, Nos. 13 to 15	3 15
13-16, Nos. 16 to 18	3 25
13-16, Nos. 19 and 20	3 35
13-16, No. 21	3 45
13-16, No. 22	3 55
¾, Nos. 13 to 15	3 25
¾, Nos. 16 to 18	3 35
¾, Nos. 19 and 20	3 45
¾, No. 21	3 55
¾, No. 22	3 65
11-16, Nos. 13 to 15	3 45
11-16, Nos. 16 to 18	3 55
11-16, Nos. 19 and 20	3 65
11-16, No. 21	3 75
11-16, No. 22	3 85
⅝, Nos. 13 to 15	3 85
⅝, Nos. 16 to 18	3 75
⅝, Nos. 19 and 20	3 95
⅝, No. 21	4 05
⅝, No. 22	4 15
⅝, No. 23	4 25

Light Band.

1½ to 6 by ⅛ to 3-16 in	2 25
1½ to 6 by Nos. 11 and 12	2 35
1 to 1⅜ by ⅛ to 3-16 in	2 35
1 to 1⅜ by Nos. 11 and 12	2 45
⅞ and 13-16 by ⅛ to 3-16 in	2 65
⅞ and 13-16 by Nos. 11 and 12	2 75
¾ and 11-16 by ⅛ to 3-16 in	2 95
¾ and 11-16 by Nos. 11 and 12	3 05
⅝ and 9-16 by ⅛ to 3-16 in	3 25
⅝ and 9-16 by Nos. 11 and 12	3 30
½ by ⅜ to 3-16 in	3 50
½ by Nos. 11 and 12	3 60

Wagon Box Iron.

⅞ inch, beveled edge, by Nos. 11 and 12	2 75
⅞ inch, " " " 13 and 14	3 05
¾ inch, " " " 11 and 12	3 05
¾ inch, " " " 13 and 14	3 25

Sheet Iron.

No. 10 to 14	2 45
No. 15 to 17	2 65
No. 18 to 21	2 75
No. 22 to 24	2 85
No. 25 to 26	2 95
No. 27	3 05
No. 28	3 25

Iron Boiler Plates.

Tank, ¼ inch and heavier	2 35
C No. 1, " "	2 60
C H No. 1 " "	2 85
C H Flange, " "	3 55
Extra Flange, "	3 95
Solid Fire Box, "	4 85

Steel Boiler Plates—1-4 in. and Heavier.

Tank	2 55
Shell	2 95
Flange	3 20
Marine Flange	3 70
Fire Box	4 35

Above includes plates 90 inches wide.

90 to 96 in. wide	½c ℔ extra
96 to 100 in. wide	1 c "
100 to 104 in. wide	1½c "
104 to 116 in. wide	special

American Cast Tool Steel.

ROUND, SQUARE AND OCTAGON.	cts. ℔s
1 to 2 in. inclusive	09
9-16 to ½ in "	09
7-16 to ⅜ and 2⅜ to 3 in	10½
3⅛ to 4 in	11
⅝ to 11-16 and 4⅛	10½
⅛ to 6 in	11½
¼ to 9-32 and 6⅛ to 7 in	12
3-6 in	14

Flats.

	cts. ℔s
2 to 9-16 wide by 2 to ⅝ thick	0

Bessemer and O. H. Steel.

	ct. ℔
Machinery	base price, 02¾
Tire	" 02¾
Spring	" 03¼
Sleigh Shoe	" 02¾
Toe Calk	" 03
Cutter Shoes, tapered and burr	" 03

English Tool Steel.

Jessop's	16c
Hobson's "Best"	16c
" "Choice"	36c

Burden Boiler Rivets.

½, ⅝, 11-16 and ¾ inches diameter	4 00
Bridge ½, ⅝, 11-16 and ¾ inch diam	4 00

SCRAP IRON AND OLD METAL.

	Net Ton.
No. 1 R. R. wrought scrap	$19 20
No. 1 wrought scrap	18 00
No. 1 Machine cast scrap	14 00
Stove Plate (free from burnt iron)	10 50
Grate Bars	9 00
Pipes and flues (Clean)	13 00
Tank iron	12 50
Hoop and band iron	10 00
Iron axles	24 00
Light sheet iron	10 00
Axle turnings	15 00
Wrought turning (free from cast)	13 00
Wrought iron, oily drillings	12 00
Cast borings	10 00
Malleable iron	11 50
Uncut wrought iron boilers	10 00
Steel boiler plates	14 50
Old iron T rails	gross tons 22 00
Old steel rails	19 50
Car wheels	20 00
Old copper	℔ 10
No. 1 H. red Brass	11
Heavy yellow brass	9½
Light yellow brass	6
Scrap Zinc	3
Tea Lead	3
Heavy Lead	3¼

H. P. Hussey. Geo. H. Pomeroy.

HUSSEY & POMEROY,

EXCLUSIVELY PIG IRON,

Strong Foundry and American Scotch Irons, Gray Forge and Bessemer Irons for steel purposes.

Room 57, Grand Arcade, Cleveland, O.

MACHINERY SUPPLY MARKET.

Anvils.

American	℔ 9@10
Wrights	℔ 9½

Bellows.

Blacksmiths'	{ Hill's dis 40
	{ Bullock's dis 50&10
Moulders'	dis 40@40&10
Hand	dis 40&10@50

Belting.

Boston Belting Co's standard	dis 70@70& 5
" " " extra	dis 60&5@60&10
" " " best	dis 55
Hoyt's Short Lap	dis 45
Cleveland Rubber Co. extra standard	dis 60&10
Shultz Raw Hide Leather Belting, single	dis 30
Shultz Raw Hide Leather Belting, double	dis 35
Standard, oak tanned	dis 55@60
Alexander Brothers' pure oak tanned	dis 45

Blowers and Exhausters.

B. F. Sturtevant's	dis 20
Boston Blower Co.	dis 35
Buffalo	dis 35

Borax.

	℔ 9½@10½

Chalk.

White	℔ gross 50
White Crayon	℔ gross 12@12½ dis 10
Red	dis 70
Blue	dis 85

Chucks.

Cushman's 4 Jaw Independent	dis 40
" Combination	dis 40
" Geared Scroll	dis 30
" 2 Jaw Brass Workers	dis 25
" Drill	dis 35
Wescott's Scroll Combination	dis 30
" Independent	dis 40
" Little Grant Drill	dis 30
Horton's Universal & Ind	dis 40
National Combination	dis 40
Sweetland "	dis 40
Skinner "	dis 40
" Light Independent	dis 50
Almond Drill	dis 25
Morse "	dis 15

Cutters and Reamers.

Cleveland	dis 10@15
Pratt & Whitney	dis 10@15
Standard	dis 10@15
Brown & Sharpe, Milling Cutters	dis 15
" " Gear Cutters	dis 15

Crowbars.

Cast Steel	℔ 4
Iron, steel points	℔ 3½

Drill and Drill Stocks.

Twist drills	dis 50&10
Morse Taper and Straight shank to 1½"	dis 50&10
Morse Taper and Straight shank Larger than 1½"	dis 25
Drill Sockets	dis 20
Standard	dis 50&10
Cleveland	dis 50&10

Emery.

	No. 4 to No. 46 gr.	No. 54 to 150. gr.	Flour, F.	C. F. FF.
Kegs, ℔	4 c	5 c		2½c
½ kegs ℔	4¼c	5¼c		2¾c
¼ kegs ℔	4½c	5½c	3 c	
10 ℔ cans, 10 in case	6 c	6½c	5 c	
10 ℔ cans, less than 10	10 c	10 c		7½c

Emery Cloth and Paper.

Barder, Adamson & Co	dis 40@46
H. H. Barton	dis 40@46

Emery Wheels.

Detroit	dis 50@60
Norton's	dis 55@60
Grant	dis 55@60
Union Stone	dis 60
Sterling	dis 60
Vulcanite	dis 15@20
Celluloid	dis 10
Northampton	dis 55
Crystal	dis 65@70
Vitrified	dis 60

Files.

Nicholson	dis 60&10@60&10&10
" X. F	dis 25
Kearney & Foot	dis 60&10@60&10&10
Black Diamond	dis 60&10@60&10&10
Arcade	dis 65@70
Disston's	dis 65@70
Western	dis 70
Stub's	dis 25
Grobet's	dis 30
Reynolds Bros.' Hand Cut	dis 50

Hammers.

P. S. W	dis 40
Atha new list, Jan. 15, 1887	dis 50
Heavy hammers and sledges under 5 lbs. 18c over 5 lbs 14c, new list.	

Jack Screws.

Illinois Bolt Co. list	dis 70

Nuts and Washers.

Size of bolt inches	¼	5-16	⅜	½	⅝	¾	1
Square	8	7	5½	4¼	4	3¼	3½
Hexagon	15½	11½	8½	6	5¼	5¼	5
Washers	9	8	7	5	4½	4½	4½

In lots less than 100 lbs, ℔ lb add ½c., 1 lb boxes add 1c to list.

Nails (wire.)

List July 14, 1887	dis 70 &10
Standard Penny Nails, ℔ keg card rate	
{ Car lots	$2.50
{ Less than car lots	$2.60

Oilers.

Zinc and Tin	dis 60
Brass and Copper	dis 50
Malleable (Hammer's), No. 1, $3.60; No. 2, $4.00; No. 3, $4.40 ℔ doz	dis 10@10&10

Packing, Steam.

Boston Belting Co.	dis 60
American Packing Hemp	℔ 10@11
Russia Packing "	℔ 14
Italian Packing "	℔ 13@14
Plumbago Piston	℔ 40
Morrison's "	℔ 50
Square Flax "	℔ 70
Sheet Rubber	℔ 12@24
Excelsior Rubber	℔ 48

Picks.

Railroads, 5 to 6 lbs	$12 dis 60&5@60&10
" 6 to 7 lbs	$13 dis 60&5@60&10

Pulleys.

Iron Pulleys, Walker List	dis 45
Medart Pulleys	dis 55
Split Wood Pulleys	dis 45

Rivets.

Iron, Thousand, list November 17,	dis 50@50&10
Iron, Ordinary, Cooper's Block and Carriage list November 17	dis 50
Copper	dis 50@50&10

Rope.

Manilla, ½ inch and over	℔ 15¼
Sisal, ½ inch and over	℔ 13¼

Sand Paper.

B. A. & Co	dis 40@40&10
H. H. Barton's	dis 40@40&10
New England Flint	dis 40@40&10
Barton's Garnet	dis 20

Saws.

Disston's Circular	dis 45
" Band	dis 20
" Scroll	Net
Hack Saw Stubs	dis 20
" " Eureka	dis 20
" " Star	dis 20
Saw Swages Disston's	dis 20
Atkins' Cicular Saws	dis 50
" Mill, Mulay and Drag Saws	dis 40&10
" Wood Saws	dis 40&10
" Silver Steel Diamond Cross-cut Saws	dis 70c per ft
" Dexter Cross-cuts	dis 50c "
" Diamond "	dis 30c "
" Tuttle Tooth Cross-cuts	dis 25c "
" One-man Cross-cuts	dis 32c "
No. 1 Handles	dis 23c per pair
No. 6 "	dis 16c "
Excelsior Saw Tools	$6 per doz
Perfection "	$15 "

Screws.

Wood Screws—List Jan 27, 1889.

Flat head iron	dis 50
Round head iron	dis 40
Flat head brass	dis 45
Round head brass	dis 35
Square Cap	dis 65
Hexagon Cap	dis 60
Set C. H. C. P	dis 70
Machine, flat head, iron	dis 55
Machine, round head, iron	dis 50
Bench and hand—	
Lag or coach	dis 75@75&10
Coach, patent gimlet point	dis 75

Shovels and Spades.

Ames' list November 1, 1885	dis 20
Dennis	dis 5.25
Hussey & Binns, railroad	dis 8.00

Taps.

Cards, Hand and Nut to 2 in	dis 50
Carpenters' " " "	dis 50
Morse " " "	dis 50
Pratt & Whitney " "	dis 25
Machine Screw Taps	dis 55
Pipe Taps to 2½ in	dis 70
Stay Bolt Taps	dis 25
Stove Bolt Taps	dis 50
Pulley Taps	dis 40

Twine.

	BC.	B.
No. 12, Flax Twine, ¼ and ½ ℔ Balls	21c@29c	
No. 18 " " ¼ and ½ "	18c@28c	
No. 36 " " ¼ and ½ "	16c@27c	
2-Ply Hemp, ¼ & ½ ℔ Balls (Spring Twine)	11½c	
3-Ply " 1 ℔ Balls	12@12¼c	
3-Ply " 1½ ℔ Balls	11@11¾c	
Cotton Wrapping, 5 Balls to ℔	15@16c	

Vises.

Solid Box	dis 60
Parker's	dis 20@25
Prentiss	dis 20
Stephen's	dis 25@30
Barrett's	dis 30
Miller's Falls	dis 40
Merrill's	dis 10@15
Howard	dis 30

Wire.

New List, Jan. 18, 1884

Brass and copper	dis 20@25
Bright and annealed, Nos. 0@18	dis 70&10@75
" " Nos. 19@26	dis 75@75& 5
" " Nos. 27@36	dis 75&10& 5
Coppered Nos. 0 to 18, market list	dis 70@70& 5
Galvanized Nos. 0 to 18 " "	dis 65&5
Tinned market Nos. 0 to 18	dis 67½
Cast steel	dis 50
Tinned Broom Wire	dis 70&5@70&10
Annealed Fence, Nos. 8 and 9	dis 75
Annealed Grape, Nos. 10 to 14	dis 75
Stub's Steel Wire regular	$6.00@℔ dis 30

Wrenches.

Coe's genuine, cash in ten days	dis 50
Girard Standard	dis 70&10
Agricultural	dis 75&10
Mechanics'	dis 55&10,& 3
Bemis & Call's Combination	dis 35
Donohue's Engineers	dis 20&10
Lamson & Sessions Engineers	dis 60
Billings & Spencer's Drop Forged	dis 10
William's " "	dis 10
Alligator " "	dis 40

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LAKE SUPERIOR AND MENOMINEE RANGE

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HARDWARE MARKET.

Augers and Bits.

ommon augers and bits.....dis 70
nell's.....dis 60&5
Cook's Douglass Mfg. Co.....dis 55
Russell Jennings' augers and bits.....dis 25
Expansive Bits, Clark's small, $18; large, $26.....dis 35@35&5
Hollow Augers, Ives'.....dis 25&10
Hollow Augers, Bonney's Adjust. ₱ doz., $48.....dis 40&10
Hollow Augers, Stearns' Adjust. ₱ doz., $48.....dis 20&10
Gimlet bits, common.....per gross $2 75@3 25
Standard Bit Stock Drills.....dis 50&10&5
Ship Augers.....dis 15&10@15&10&5

Axes.

Makers' and Special Brands—
First quality.....₱dox. $6 00@6 50
Others.....₱doz. $5 50@5 75
Full polished.....$8 00

Bolts.

Cast iron barrel bolts.....dis 70@70&10
Cast iron shutter bolts, etc.....dis 70@70&10
Cast iron chain bolts.....dis 65&10
Ives' patent door bolt.....dis 60
Wrought iron barrel bolts.....dis 70@70&10
Wrought iron square bolts.....dis 70@70&10
Wrought shutter bolts.....dis 60&10
Sargent's list
Carriage, common, new list.....dis 75&2½&2
Tire, common, new list.....dis 70
Carriage and tire, Philadelphia pattern.....dis 75&10
Stove bolts.....dis 62½
Plow bolts.....dis 60&5
Machine.....dis 75&10@80
Ends.....dis 75&10&80

Butts.

Wrought brass.....dis 70@70&10
Cast brass, loose joint.....dis 33⅓&10
Cast Iron—
Fast joint, narrow.....dis 50&10&5@60&5
Fast joint, broad.....dis 55&10&5@60&10
Loose joint.....dis 70&10@75
Loose joint, jap.....dis 70&10@75
Loose joint, jap. with acorns.....dis 70&10@75
Loose pin, acorns.....dis 70&10@75
Loose pin, japanned acorns.....dis 70&10@75
Loose pin, acorns, jap. plated tips..dis 70&10@75
Wrought steel—
Wrought, fast joint, narrow.....dis 70&10@75
Wrought, fast joint, broad.....dis 70&10@75
Wrought, loose joint, broad.....dis 70&10@75
Table Butts, back flaps, etc.....dis 70&10@75
Regular inside blind.....dis 70&10@75
Light inside blind.....dis 70&10@75
Loose pin.....dis 70&10@75
Light loose pin.....dis 70&10@75

Chains.

Trace, 6½-10-2.....₱ pair 1.03)
Trace, 6½-10-3.....₱ pair .92) 50&10@50&10&5
Trace, 7-10-2.....₱ pair 1.11)
German Halter Chain, list June, 1887...dis 50&10
German Coil, list of June, 1887..dis 50&10&5@60
Galvanized Pump Chain.....₱ lb5½@6
Jack Chain, Iron.....dis 75@75&5
Jack Chain, Brass.....dis 70@70&5

Chisels.

Socket Framing and Firmer.....dis 75&5@75&10
Socket Framing and Firmer, Buck Bros..dis 30
Socket Firmer and Framing, L. & I. J. White.....dis 30@30&5
Tanged Firmers.....dis 40&10

Cutlery.

Table.....net
Excelsior Pocket.....net

Gimlets.

Nail and Spike.....dis 50&10&5
Double cut, low list.....dis 25
"Bee".....₱ gross $12, dis 25@25&5

Hangers.

Barn door, old patterns.....dis 10&10@70
Climax, Anti-Friction.....dis 70
Star.....dis 40&10@40&10&5
Scranton.....dis 40
Kidder's.....dis 50&10@60
Terry's Patent.....5 in., $12; 4 in., $10, dis 50&5
Paragon.....dis 40&10
Richard's.....dis 30@30&10

Horse Nails.

	No. 10	9	8	7	6	
Ausable, ₱ lb.	23	24	25	26	28.	dis 25&10@25&10&10
Putnam, ₱ lb.	18	19	20	21	23.	dis 15
Essex						dis 25&10@25&10&10

Horse Shoes.

Burden, at factory.....₱ keg $4 00
R. I. Horshoe Co., Perkins' Imp. at factory.....₱ keg $4 00
Mule Shoes, at factory.....₱ keg $5 00

Knobs.

Carriage, japanned.....₱ gross 80c dis 60&10
Base, rubber tip.....dis 70&10&5
Hemacite door knobs, new list.....dis 40&10@50
Door mineral.....dis 65c@68c
Door Por. japanned.....dis 75c@78c
Door Por. nickle.....$2 00@2 25
Door Por. plated.....$2 00@2 25

Locks, Bolts, Etc.

P. & F. Corbear, Locks and Bronze Goods.
Door locks, knobs and latches.....dis 60
Escutcheons and keys.....dis 60
Padlocks and padlock keys.....dis 66⅔
Bell pulls, mineral, porcelain and jet.....dis 60
Bell pulls, genuine bronze.....dis 60&10
Lever bell pulls, genuine bronze.....dis 60&10
Butts', genuine bronze.....dis 60&10
Butts' bronze plated.....dis 60&10
Store door locks and latches.....dis 60&10
Store door handles.....dis 60&10
Shutter hinges&flaps, genuine bronze.dis 60&10
Shutter hinges, bronze plated.....dis 70
Flush bolts, genuine bronze.....dis 70
Shutter knobs, genuine bronze.....dis 50
Shutter bars, genuine bronze.....dis 60
Sash lifts, genuine bronze.....dis 60
Sash pulls and plates, genuine bronze.....dis 60
Push plates, genuine bronze.....dis 60
Drawer pull, genuine bronze.....dis 66⅔
Letter box plates, genuine bronze...dis 60&10
Barn door locks.....dis 33⅓

Plumbs and Levels.

Standard list.....dis 70&10@70&10&10
Pocket levels.....dis 70&10@70&10&10
Davis' inclinometers.....dis 10&10

Pumps.

Cistern, best makers.....dis 50&10@60
Pitcher spout, best makers.dis 60&10@60&10&10
Pitcher spout, cheaper goods dis 70&5@70&10&5

Rakes.

Cast steel.....dis 65
Malleable.....dis 70@70&5

Razors.

J. R. Torrey Razor Co.....dis 20
Wostenholme & Butcher.....$10@4...dis 10
Rifle razor.....dis $9 50 net

Scales.

Hatch, Counter, No. 171.....₱ doz $21 00
Hatch, Tea, No. 161.....₱ dox $6 75@7 00
Chatillon's Grocers.....dis 50
Family Turnbulls.....dis 30@30&10
Scale Beams, List of January 12, 1882.....dis 50&10@50&10&4

Screw Drivers.

Stanley R. & L. Co.'s Varnished Handles.....dis 65&10
Stanley R. & L. Co.'s Black Handles..dis 60&10
Sets interchangeables.....₱ doz $18 dis 25

Squares.

Steel and iron.....
Nickel plated.....} dis 75&10@80
Disston's try square and T bevels.....dis 45&10
Winterbottom's try and miter.....dis 30&10

Tacks, Brads, Etc.

New List, January 2, 1888.

American iron carpet tacks all kinds.....dis 80@80&5
Steel carpet tacks all kinds.....dis 80@80&5
Swedes iron carpet tacks, all kinds.....dis 80@80&5
Swedes iron tacks.....dis 75&5@75&10
Swedes iron Upholsterers' tacks.....dis 75&10@75&10&5
Tinned Swedes iron tacks..dis 75&10@75&10&5
Tinned Swedes iron Upholsterers' tacks.....dis 75&10@75&10&5
American iron cut tacks.....dis 75@75&10
Copper tacks.....dis 50&10
Copper finishing and trunk nails.....dis 50&10
Cigar box nails.....dis 50&10@50&10&5
Finishing nails.....dis 70&10@70&10&10
Hungarian nails and miners' tacks.....dis 70&10@70&10&10
Gimp and lace tacks.....dis 75&10@75&10&5
" " " tinned.dis 75&10@75&10&5
Trunk and clout nails.....dis 70&10@70&10&10
Tinned trunk&clout nails.dis 70&10@70&10&10
Basket nails.....dis 70&10@70&10&10
Chair nails.....dis 70&10@70&10&10
Common and patent brads.dis 70&10@70&10&10
Tinned capped trunk n'ls..dis 70&10@70&10&10

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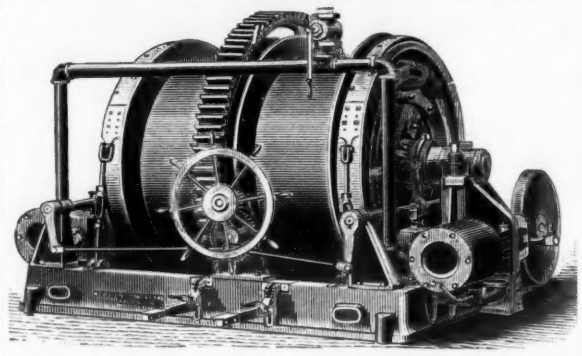
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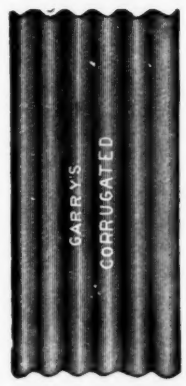

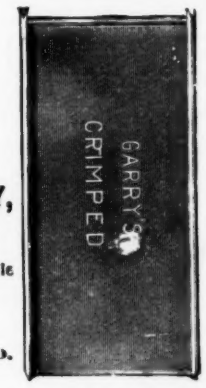

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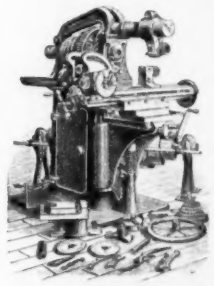
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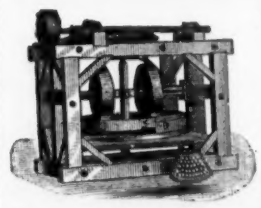
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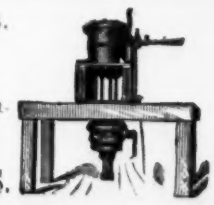
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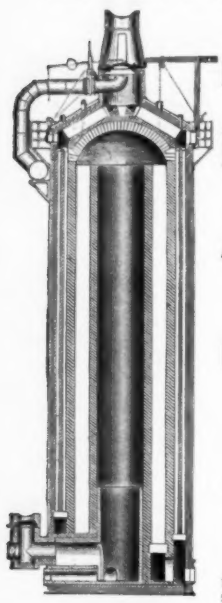

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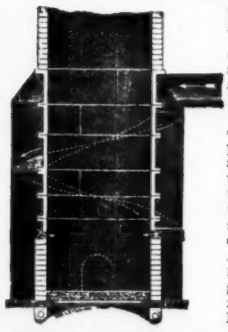

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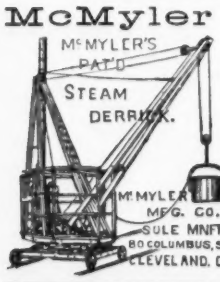

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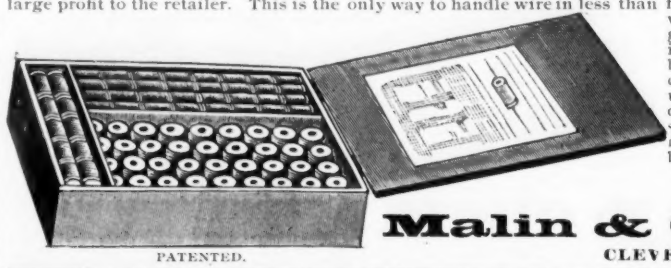

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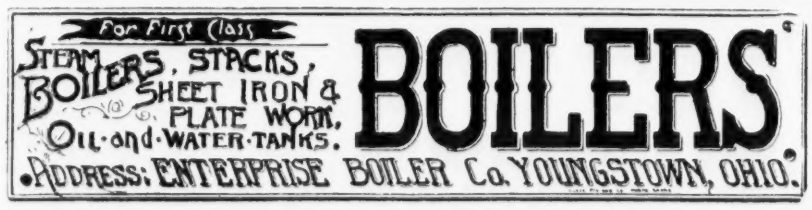
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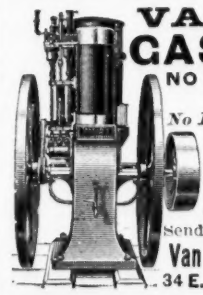

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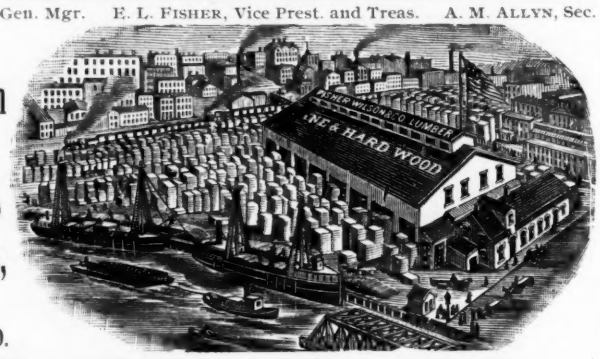

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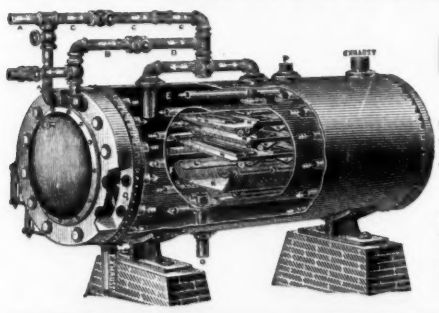

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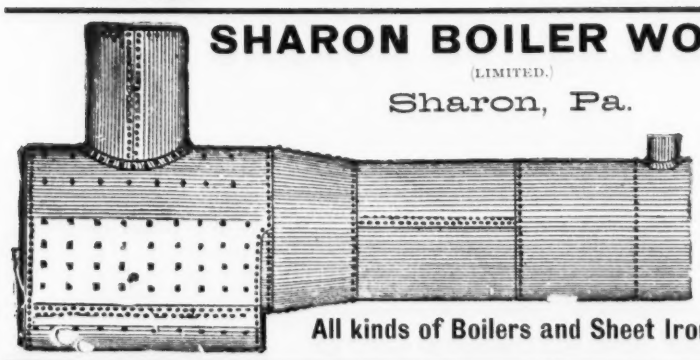

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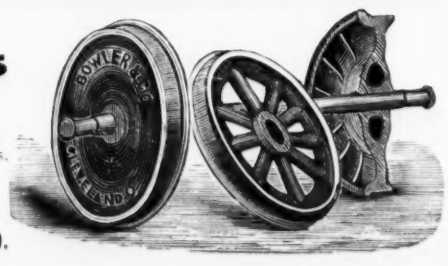

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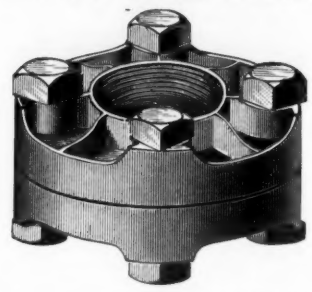

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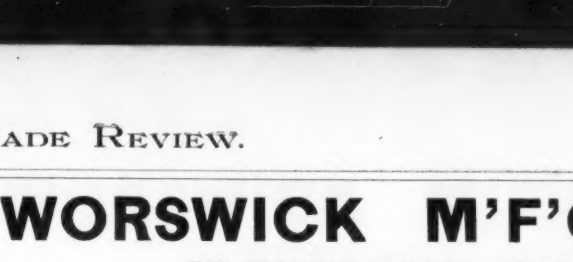

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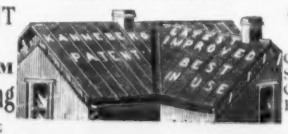

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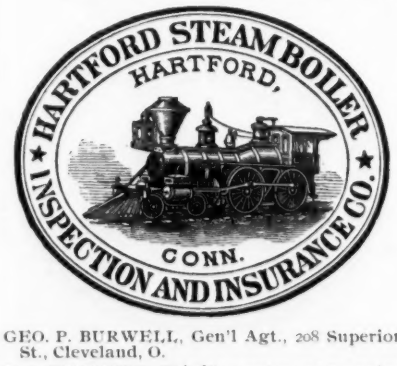

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Joseph A. Osborne, William M. Monroe, Of the U. S. Supreme Ct. Bar. Patent Expert.
Osborne & Monroe,
PATENTS
29 EUCLID AVE., CLEVELAND, O.
Patent Causes litigated in the United States Supreme and Circuit Courts. **UNITED STATES AND FOREIGN PATENTS PROCURED.** Searches and Opinions as to the Scope, Validity and Infringement of patents. Terms Reasonable.

PATENTS.
M. D. & L. L. LEGGETT,
Attorneys at Patent Law.
Patents obtained in the United States and in Foreign countries.
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TRAVELERS' REGISTER.

Standard Time.
Revised March 6th, 1888.

N. Y., C. & St. L. R. R. Co.—"The Nickel Plate."

Eastward.	Arrive.	Depart.
Buffalo Passenger	10 40 a m	10 45 a m
Chicago Passenger	9 20 p m	.....
Local Freight	4 40 p m	7 30 a m
Westward.	**Arrive.**	**Depart.**
Chicago Passenger	.....	6.30 a m
Fostoria Passenger	5 06 p m	5 11 p m
Local Freight	1 00 p m	5 50 a m

Rocky River Accommodation departs 7:40 a. m.; 1:40 p. m.

Euclid Accommodation departs 6:24 a. m.; 5.05 p. m.

All trains daily, except Sunday.

Cleveland & Pittsburgh.

	Arrive.	Depart.
New York Express	12 50 p m	7 45 a m
New York Express	6 35 p m	1 35 p m
Alliance & Akron Accom	9 35 a m	3 25 p m
Ravenna Accommodation	8 25 a m	5 00 p m
Night Express	*5 25 a m	*11 10 p m

*Daily; all other trains daily, except Sunday.

Mt. Vernon & Pan Handle Route.

C., A. & C. Ry. Co.	Arrive.	Depart.
Akron, Col. & Cin. "Flyer"	5 40 p m	8 10 a m
Akron, Col. & Cin. Night Express	7 00 a m	8 00 a m
Akron, Col. & Zanesv'e Ex	12 50 p m	1 35 p m
Akron & Orrville Accom	9 35 a m	3 25 p m

The 8 p. m. train runs daily. Elegant Pullman palace sleeping cars attached. All other trains daily, except Sunday.

Erie Railway.

Depot, South Water Street and Viaduct.

	Arrive.	Depart.
N. Y. & Pitts. Express	‡5 38 a m	*8 25 a m
Fast N. Y. & Pitts. Express	*10 55 a m	*3 00 p m
Mahoning Accommo		†6 40 a m
Pittsburgh Express	†6 25 p m	
Youngstown Local	†8 05 a m	
Mahon'g div. & Pitts Local		*11 40 a m
Mahoning Val. Accom		†4 30 p m
Pittsburgh Express	†1 20 p m	11 10 p m
New York Express	*8 00 p m	.....

*Daily. †Daily, except Sunday. ‡Daily except Monday.

Cleveland & Canton Railroad.

Depart—
Canton and Coshocton—7:00 a. m., 3:15 p. m.
Bedford—7:00 a. m., 11:10 a. m., 2:00 p. m., 3:15 p. m., 4:40 p. m., *5:45 p. m., 10:35 p. m.
Newburgh—6:12 a. m., 7:00 a. m., 11:10 a. m., 2.00 p. m., 3:15 p. m., 4:40 p. m., *5:45 p. m., 7:30 p. m., 10:35 p. m.
Kent—7:30 a. m., 3:15 p. m., *5:45 p. m.
Arrive from—
Canton and Coshocton—8:50 a. m., 6:55 p. m.
Bedford—6:00 a. m., *8:12 a. m., 9:50 a. m., 1:05 p. m., 4:05 p. m., 6:40 p. m., 7:10 p. m.
Newburgh—6:00 a. m., *8:12 a. m., 9:50 a. m., 1.05 p. m., 4:05 p. m., 6:40 p. m., 7:10 p. m., 9:10 p. m.
Kent—*8:12 a. m., 9:50 a. m., 6:55 p. m.

Theatre train leaves Cleveland 10:35 p. m. and runs through to Newburgh and Bedford daily, except Sunday.

Trains marked with * run daily. All others daily, except Sunday.

Depot at Ontario St., opposite Huron St.

Valley Railway.

FOR AKRON, CANTON AND MARIETTA.

Depot foot South Water Street.

	Depart.	Arrive.
Valley Junction Mail	*7 45 a m	*6 30 p m
Marietta Express	†11 15 a m	†2 30 p m
Valley Junction Express	*4 15 p m	*10 15 a m
Cleve. and Canton Express	*7 00 p m	†8 15 a m

*Daily. †Daily, except Sunday.

WM. THORNBURGH, Gen. Manager. R. A. CARRAN, Gen. Pass. Agt.

Cleveland, Lorain and Wheeling.

All trains arrive and leave the Union Depot as follows:

	Depart.	Arrive.
Wheeling Express	6 45 a m	6 55 p m
Uhrichsville Express	4 00 p m	9 20 a m

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ERIE RAILWAY.

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—AND—
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—TO—
New York, Boston and the East.

The shortest and quickest Route to Pittsburgh, Washington and Baltimore & the Southeast.

New Central Depot So. Water St. and Viaduct.

	Depart.
No. 62, Accommodation	† 6 00 a m
No. 72, New York Express	* 8 30 a m
No. 72, Fast Pittsburgh Express	* 8 30 a m
No. 64, Fast Pittsburgh Express	* 3 00 p m
No. 66, Leavittsburgh Accommo.	* 4 20 p m
No. 68, Pittsburgh Express	†10 50 p m
No. 68, New York Express	†10 50 p m
No. 70, Pittsburgh Local Express	†11 45 a m
No. 74, Youngstown Express	† 4 20 p m
	Arrive.
No. 65, Fast New York Express	*12 50 a m
No. 61, Pittsburgh Express	* 7 35 a m
No. 67, Pittsburgh Express	†10 55 a m
No. 63, New York Express	* 6 50 p m
No. 63, Pittsburgh Express	* 6 50 p m
No. 69, Pittsburgh Local Express	† 9 10 p m
No. 13, Accommodation	† 5 25 p m

*Daily. †Daily, except Sunday.

Baggage checked through to all points East.

Through tickets and information regarding the route can be obtained at office, 141 Superior street, and at Depot N. Y., P. & O. Railroad, South Water street and Viaduct, Cleveland.

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L. P. FARMER, Gen. Pass. Agt., New York.
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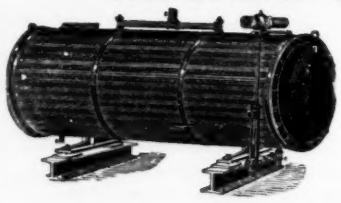

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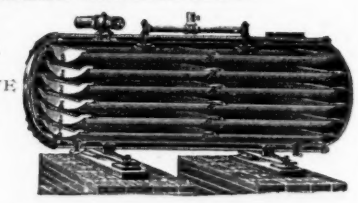

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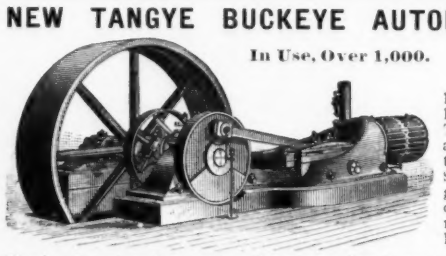

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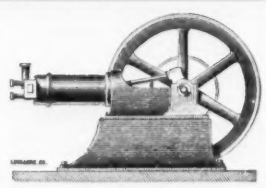

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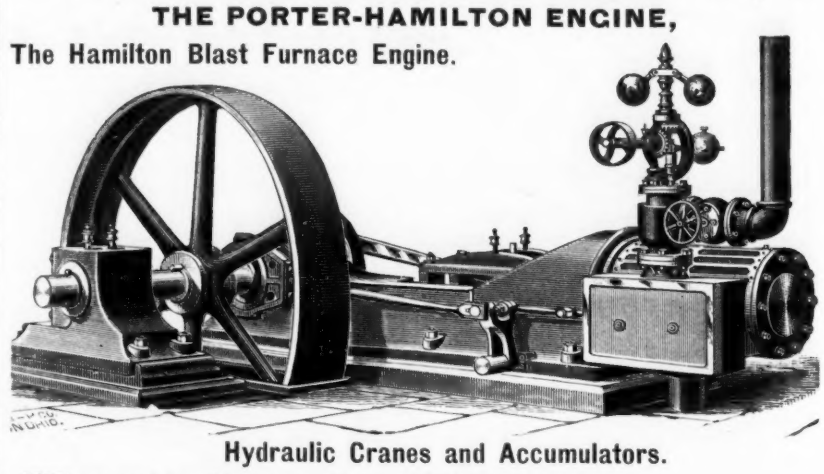

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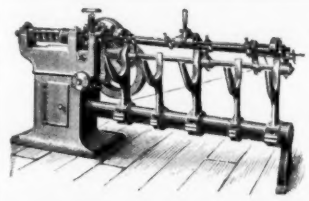

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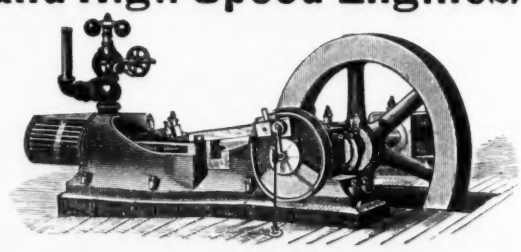

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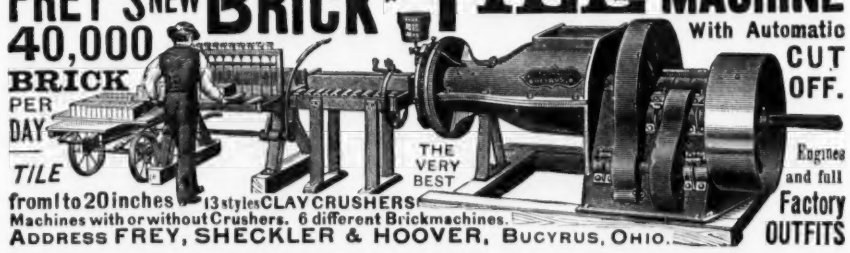

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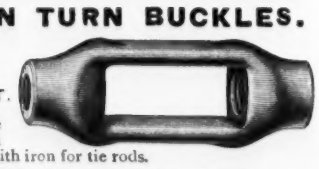

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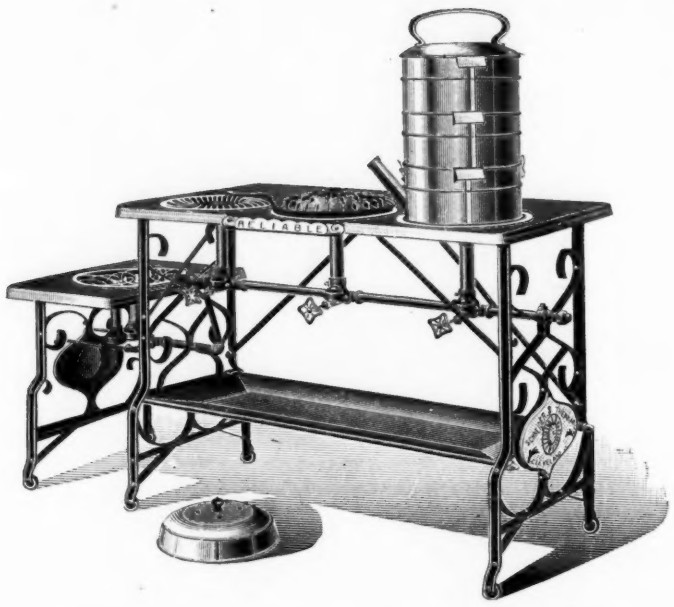

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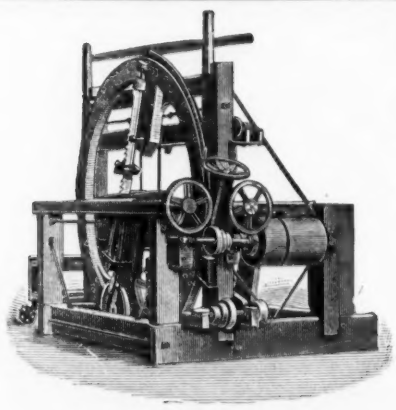

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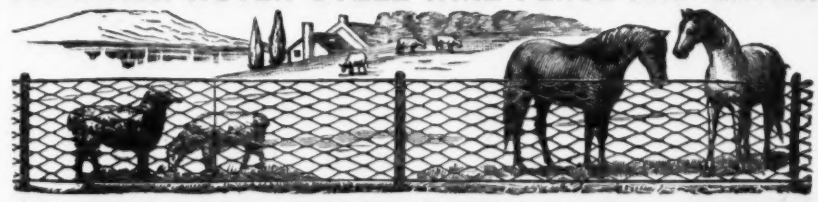

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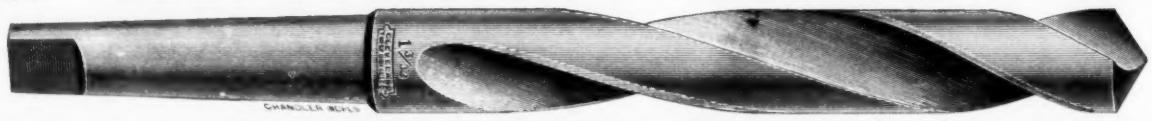

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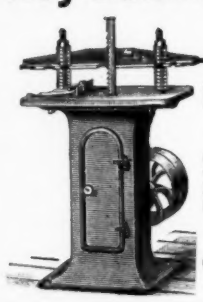

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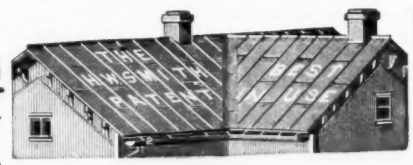

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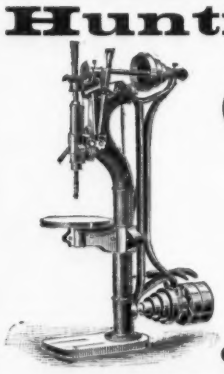

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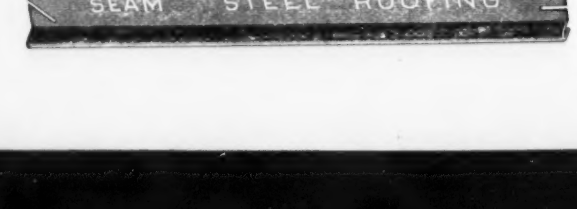

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